

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือ

ง-1

คุณภาพอากาศ เสียงและความสั่นสะเทือน

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	22062020	22 Jun 20	21 Jun 22	-
2	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	G25A 158M	Tisch Environmental, Inc.	22062020	22 Jun 20	21 Jun 22	-
3	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3393	Tisch Environmental, Inc.	27072020	27 Jul 20	26 Jul 22	-
4	Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 163268	Innovative Instrument Co., Ltd.	21-TPM-335	1 Dec 21	30 Nov 22	-
5	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M	Technology Promotion Association (Thailand-Japan)	21P446	9 Feb 21	8 Feb 22	-
6	Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	- 159822	NIST Traceable Calibration Facility	21-AFM-095	31 Aug 21	30 Aug 22	-
7	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21P435	8 Feb 21	7 Feb 22	-
8	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	21H803	8 Apr 21	7 Apr 22	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778106	UAE Consultant Co., Ltd.	30072021	30 Jun 21	29 Jun 22	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co., Ltd.	20072021	20 Jul 21	19 Jul 22	-
11	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497724	UAE Consultant Co., Ltd.	10112021	10 Nov 21	9 Nov 22	-
12	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497725	UAE Consultant Co., Ltd.	10112021	10 Nov 21	9 Nov 22	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
13	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	160-401526192-1	30 Jul 19	30 Jul 22	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920016	UAE Consultant Co.,Ltd.	08012021	8 Jan 21	7 Jan 22	-
15	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778111	UAE Consultant Co.,Ltd.	14062021	14 Jun 21	13 Jun 22	-
16	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920012	UAE Consultant Co.,Ltd.	09112021	22 Nov 21	21 Nov 22	-
17	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920013	UAE Consultant Co.,Ltd.	09112021	22 Nov 21	21 Nov 22	-
18	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	160-401526192-1	30 Jul 19	30 Jul 22	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636464	UAE Consultant Co.,Ltd.	24112021	24 Nov 21	23 Nov 22	-
20	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636465	UAE Consultant Co.,Ltd.	24112021	24 Nov 21	23 Nov 22	-
21	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920018	UAE Consultant Co.,Ltd.	05032021	5 Mar 21	4 Mar 22	-
22	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48C-62460-355/5	UAE Consultant Co.,Ltd.	03032021	3 Mar 21	2 Mar 22	-
23	Standard Gases (Mixture)	Carbon Monoxide	Airgas	CC159599 2015PSIG	Airgas an Air Liquide company	160-401526192-1	30 Jul 19	30 Jul 22	-
24	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 93JN1MN9	UAE Consultant Co.,Ltd.	16072021	16 Jul 21	15 Jul 22	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
25	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 KWWV1R96	UAE Consultant Co.,Ltd.	09062021	9 Jun 21	8 Jun 22	-
26	Standard Gas	Total Hydrocarbons	Air Liquide	CC143232	Air Liquide	E03AI99E15A006C	16 Oct 20	16 Oct 28	-
27	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11355	Calibration Laboratory Co.Ltd	Q21034735	21 Apr 21	20 Apr 22	-
28	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11060	Instantel Inc.	721A2601	25 Jun 21	24 Jun 22	-
29	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	SvanteK	SV35A 73249	Innovative Instrument Co.,Ltd.	21-ACT-187	28 May 21	27 May 22	-
30	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6171	Innovative Instrument Co.,Ltd.	21-ACT-327	24 Aug 21	23 Aug 22	-
31	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax} เสียงรบกวน	Larson Davis	LxT2 0005406	Larson Davis-A PCB Piezotronics Div.	2021000506	15 Jan 21	14 Jan 22	-
32	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax} เสียงรบกวน	Larson Davis	LxT2 0005407	Larson Davis-A PCB Piezotronics Div.	2021000734	21 Jan 21	20 Jan 22	-
33	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax} เสียงรบกวน	Larson Davis	LxT2 0005394	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 23	-
34	Sound Level Meter	$L_{Aeq\ 24\ hours}$, L_{Amax} เสียงรบกวน	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	22-ACT-035	21 Jan 22	20 Jan 23	-

Certificate of Calibration

Calibration Certification Information					
Cal. Date:	June 22, 2020	Rootsometer S/N:	438320	Ta:	296 °K
Operator:	Jim Tisch	Pa:	748.0		mm Hg
Calibration Model #:	TE-5025A	Calibrator S/N:	1901		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3620	3.2	2.00
2	3	4	1	0.9580	6.4	4.00
3	5	6	1	0.8590	7.9	5.00
4	7	8	1	0.8160	8.8	5.50
5	9	10	1	0.6750	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)	
0.9867	0.7244	1.4078	0.9957	0.7311	0.8896
0.9824	1.0255	1.9909	0.9914	1.0349	1.2581
0.9804	1.1414	2.2259	0.9894	1.1518	1.4066
0.9792	1.2001	2.3345	0.9882	1.2111	1.4753
0.9739	1.4429	2.8155	0.9829	1.4561	1.7792
QSTD			QA		
m= 1.95981			m= 1.22720		
b= -0.01429			b= -0.00903		
r= 0.99998			r= 0.99998		

Calculations		For subsequent flow rate calculations:	
Vstd= ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)	Va= ΔVol((Pa-ΔP)/Pa)	Qstd= Vstd/ΔTime	Qa= Va/ΔTime
For subsequent flow rate calculations:		For subsequent flow rate calculations:	
Qstd= 1/m $\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$		Qa= 1/m $\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$	

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsometer manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION	
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to S1, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com
TOLL FREE: (877)263-7610
FAX: (513)467-9009

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Certificate of Calibration

Calibration Certification Information					
Cal. Date:	July 27, 2020	Rootsometer S/N:	438320	Ta:	298 °K
Operator:	Jim Tisch	Pa:	749.3		mm Hg
Calibration Model #:	TE-5025A	Calibrator S/N:	3393		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3980	3.2	2.00
2	3	4	1	0.9960	6.3	4.00
3	5	6	1	0.8860	7.8	5.00
4	7	8	1	0.8430	8.7	5.50
5	9	10	1	0.7000	12.7	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)	
0.9817	0.7022	1.4042	0.9957	0.7123	0.8919
0.9776	0.9816	1.9859	0.9916	0.9956	1.2613
0.9757	1.1012	2.2203	0.9896	1.1169	1.4101
0.9745	1.1560	2.3786	0.9884	1.1725	1.4790
0.9692	1.3846	2.8084	0.9831	1.4044	1.7837
QSTD			QA		
m= 2.05151			m= 1.28462		
b= -0.03558			b= -0.02260		
r= 0.99994			r= 0.99994		

Calculations		For subsequent flow rate calculations:	
Vstd= ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)	Va= ΔVol((Pa-ΔP)/Pa)	Qstd= Vstd/ΔTime	Qa= Va/ΔTime
For subsequent flow rate calculations:		For subsequent flow rate calculations:	
Qstd= 1/m $\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$		Qa= 1/m $\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$	

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
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Ta:	actual absolute temperature (°K)
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Certificate of Calibration

Calibration Certification Information					
Cal. Date:	May 15, 2020	Rootsometer S/N:	438320	Ta:	296 °K
Operator:	Jim Tisch	Pa:	750.6		mm Hg
Calibration Model #:	TE-5025A	Calibrator S/N:	1270		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3700	3.2	2.00
2	3	4	1	0.9740	6.4	4.00
3	5	6	1	0.8670	7.9	5.00
4	7	8	1	0.8280	8.8	5.50
5	9	10	1	0.6840	12.7	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)	
0.9900	0.7226	1.4102	0.9957	0.7268	0.8881
0.9858	1.0121	1.9943	0.9915	1.0179	1.2560
0.9838	1.1347	2.2296	0.9895	1.1413	1.4042
0.9826	1.1867	2.3385	0.9883	1.1936	1.4728
0.9774	1.4290	2.8203	0.9831	1.4373	1.7762
QSTD			QA		
m= 1.99455			m= 1.24896		
b= -0.02954			b= -0.01860		
r= 0.99998			r= 0.99998		

Calculations		For subsequent flow rate calculations:	
Vstd= ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)	Va= ΔVol((Pa-ΔP)/Pa)	Qstd= Vstd/ΔTime	Qa= Va/ΔTime
For subsequent flow rate calculations:		For subsequent flow rate calculations:	
Qstd= 1/m $\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$		Qa= 1/m $\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$	

Standard Conditions	
Tstd:	298.15 °K
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Key	
ΔH:	calibrator manometer reading (in H2O)
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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
5/18 MOO 11, SOI SUNTAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRASAN PROVINCE 10140 THAILAND
TEL: 0800-2116-5000 | FAX: 0800-2116-7140

ANAB
ACCREDITED
CALIBRATION LABORATORY
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Certificate of Calibration

Customer	UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.	Certificate No:	21-AFM-095
Name		Request No:	Req-2021-0988
Address	81 Soi Udomrak 41, Sukhumvit Road, Bangchak, Puskong, Bangkok 10260		

Unit Under Calibration Details	
Measurement Item	Air Flow Meter
Manufacturer	BGI
Model	DeltaCal DC1
Serial Number	159822
ID	UAE.EPM.039.2561
Location of Calibration	LAB 4 AIR VELOCITY METER


Calibration Environment and Details	
Temperature	23 °C ± 3 °C
Humidity	55 %RH ± 20 %RH
Barometric Pressure	1013 kPa ± 10 kPa
Received Date	22 July 2021
Calibration Date	31 August 2021


Calibration Procedure: In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensodyne	21 May 2022

Traceability: This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)

Note: The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibration By: 
Mr. Noppon Luangart
Service Calibration Engineer

Approved By: 
Mr. Puch Mathavorn
Calibration Engineer Supervisor
Issue Date: 1 September 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-709-AFM-01 Rev.00 Issue date 01/07/19

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Certificate No : 21-AFM-085
Request No : Req-2021-0988

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
14.5	14.508	14.54	-0.032	0.21
15.0	15.009	15.05	-0.041	0.22
15.8	15.807	15.88	-0.073	0.23
16.6	16.605	16.70	-0.094	0.24
18.3	18.308	18.41	-0.102	0.26

Note

STD : Standard

UUC : Unit Under Calibration

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.03 Issue date 01/07/19

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Certificate No : 21-RJM-064
Request No : Req-2021-0988

Calibration Results : Without Adjustment

Temperature Calibration : Filter Temperature (Tf)

Temperature Range (°C)	Without Adjustment (°C)			Uncertainty (°C)
	STD Reading (°C)	UUC Reading (°C)	Correction (°C)	
20	19.999	20.1	-0.101	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.2	-0.196	0.10

Temperature Calibration : Ambient Temperature (Ta)

Temperature Range (°C)	Without Adjustment (°C)			Uncertainty (°C)
	STD Reading (°C)	UUC Reading (°C)	Correction (°C)	
20	19.999	20.1	-0.101	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.3	-0.296	0.10

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-TM-R Rev.03 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,
Name : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong,
Address : Bangkok 10260

Certificate No : 21-RHM-064
Request No : Req-2021-0988

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : deltaCal DC1
Serial Number : 159822
ID : UAE-EFM.039/2561
Resolution : 0.1 (°C)
Sensor Model : 2182 (Tf)
Sensor SN : MRG/024084-001
Sensor ID : UAE-EFM.039/2561
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 5 °C
Humidity : 55 %RH ± 20 %RH
Received Date : 22 July 2021
Calibration Date : 31 August 2021
Calibration By : Mr. Sitichok Jirapakdeesakun
Location of Calibration : LAB 2 Temperature
Calibration Method : In-house method CP-THM-01 by Comparison With Standard Relative Humidity Meter and Standard
Thermometer with RTD Probe in Humidity / Temperature Chamber

Reference Standard

Standard Thermometer Model: GT11, S/N: 12090077, Which was calibration on 30 March 2021, Calibration of Certificate No. : QR21-0719
and Relative Humidity Meter, Model: HP23-A, S/N: 61629979, Which was calibration on 28 September 2020, Calibration of Certificate No. :
QR20-1651

Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No. Calibration 0293

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence
approximately 95 %.

Calibrated By :
Service Calibration Engineer

Approved By :
Mr. Panch Mathawan
Calibration Engineer Supervisor
Issue Date : 1 September 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-TM-R Rev.03 Issue date 01/07/19

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-8484

Certificate of Calibration

Certificate No. : 21P446
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer : Dwyer

Model : 1221-36-W/M

Serial No. :

ID No. : UAE.EFM.180/2561

Condition As-Received: Used Item

Received Date: 01 February 2021

Calibration Date: 09 February 2021

Reference: 2102-0083/WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1012 mbar

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

81 Soi Udomsak 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure
Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0113-20	14 Jul 2021

2.This result of calibration was made on requested at the point specified by customer.

3.Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

4.This instrument was used clean air as pressure media.

5.This instrument was installed in vertical orientation and center of connector was used as the reference level.

6.The certificate is valid only to the item calibrated on date and place of calibration.

7.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Noppapat Phonngam
Issue Date : 11 February 2021

Approved Signatory :
[] Phalinee Pratsapaipal
[] Sura Suwannasri
[x] Attapol Panurach

เอกสารไม่ควบคุม

B 0250402



Cert.No.: 21P448
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure

Range: 0 inH₂O to 36 inH₂O
Scale Interval: 0.1 inH₂O (The Fifth Estimate)

UUC Indication				
Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.02	2.02	0.02
4.00	2.00	-2.00	4.00	0.00
6.00	3.02	-2.98	6.00	0.00
8.00	4.00	-3.98	7.98	-0.02
10.00	5.00	-4.98	9.98	-0.02
12.00	6.02	-6.00	12.02	0.02
14.00	7.00	-6.98	13.98	-0.02
16.00	8.00	-7.98	15.98	-0.02
18.00	9.00	-8.02	18.02	0.02
20.00	10.00	-10.02	20.02	0.02
22.00	11.00	-11.02	22.02	0.02
24.00	11.98	-12.00	23.98	-0.02
26.00	12.98	-13.04	26.02	0.02
28.00	13.98	-14.04	28.02	0.02
30.00	14.98	-15.04	30.02	0.02
32.00	15.98	-16.06	32.04	0.04
34.00	17.00	-17.06	34.06	0.06
35.50	17.78	-17.94	35.72	0.22

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม
a 1037939



Calibration Date:

Certificate No.: 21-TPM-335

UUC Adjustment: ☐ Not Adjust

Request No.: Req-2021-1406

Page: 2/2

Result of Calibration:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
T _a	20.003	20.0	0.0	0.14
	25.004	25.0	0.0	0.14
	30.004	30.0	0.0	0.14
	35.004	34.9	-0.1	0.14
	40.005	39.9	-0.1	0.14
T _f	45.005	44.9	-0.1	0.14
	20.006	20.0	0.0	0.14
	25.006	25.0	0.0	0.14
	30.004	30.0	0.0	0.14
	35.004	34.9	-0.1	0.14
	40.007	39.9	-0.1	0.14
	45.004	44.9	-0.1	0.14

End of Certificate

Calibrated By:

Mr. Noppadon Luangt

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-508-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



Certificate of Calibration

Customer: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No.: 21-TPM-335
Request No.: Req-2021-1406
Page: 1/2

Unit Under Calibration Details

Calibration Parameter: Temperature
Instrument Name: Air Flow Meter
Manufacturer: BGI
Model: deltaCal DC1
Serial Number: 163268
Resolution: 0.1 °C
ID Number: UAE.EFM.174/2561
Range Calibration: 20 °C to 45 °C
Type of Sensor: RTD
Sensor Diameter (mm): 3
Calibration Position (mm): 45
Instrument Status: Used

Calibration Environment and Details

Temperature: 23 °C \pm 3 °C
Humidity: 55 %RH \pm 15 %RH
Received Date: 29 October 2021
Calibrated Date: 1 December 2021
Calibration Procedure: In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard: Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/ RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 30 March 2021, Calibration Certificate No.: QR21-0719

Traceability: This Certificate is traceable to SI Unit through Quality Roborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Approved By: Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date: 2 December 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-508-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



Certificate of Calibration

Customer: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No.: 21-AFM-133
Request No.: Req-2021-1406

Unit Under Calibration Details

Measurement Item: Air Flow Meter
Manufacturer: BGI
Model: deltaCal DC1
Serial Number: 163388
ID: UAE.EFM.174/2561
Location of Calibration: LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature: 23 °C \pm 3 °C
Humidity: 55 %RH \pm 20 %RH
Barometric Pressure: 1013 hPa \pm 10 hPa
Received Date: 29 October 2021
Calibration Date: 1 December 2021
Calibration Procedure: In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator.

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	21 May 2022

Traceability:

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)

Note:

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By: Mr. Noppadon Luangt
Service Calibration Engineer

Approved By: Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date: 1 December 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-508-AFM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 21-AFM-133
Request No : Req-2021-1406

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
14.5	14.593	14.40	0.103	0.21
15.0	15.094	14.89	0.114	0.22
15.8	15.893	15.68	0.123	0.23
16.6	16.696	16.47	0.136	0.24
18.3	18.302	18.14	0.162	0.26

Note:
STD : Standard
UUC : Unit Under Calibration
* Indicates non accredited

End of Certificate

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม



Cert.No.: 21P2502
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	959.18	970.39	980.57	990.77	1000.79	1010.71	1020.54	1030.39
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	0.82	-0.39	-0.57	-0.77	-0.79	-0.71	-0.54	-0.39

Decreasing Pressure

Applied Pressure (hPa)	1030.46	1020.42	1010.54	1000.67	990.64	980.74	970.54	959.39
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.46	-0.42	-0.54	-0.67	-0.64	-0.74	-0.54	0.61

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No : 21P2502
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE-ANV.151/2550

Condition As-Received: Used Item

Received Date: 20 July 2021

Calibration Date: 21 July 2021

Reference: 2107-0570WSC

Ambient Temperature: (23 \pm 2) °C

Relative Humidity: (50 \pm 15) %

Atmospheric Pressure: 1009 mbar

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP1142	1422505046	MP-0053-21	06 Apr 2022

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level

3.This result of calibration was made on requested at the point specified by customer.

4.This instrument was used clean air as pressure media.

5.The certificate is valid only to the item calibrated on date and place of calibration.

6.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarnee
Issue Date : 22 July 2021

Approved Signatory :
[] Phalinee Prapthapal
[] Sura Suwanasari
[x] Atapol Panurach

เอกสารไม่ควบคุม
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Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 21-AFM-895
Request No : Req-2021-0988

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : deltaCal DC1
Serial Number : 159822
ID : UAE-EFM.039/2561
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C \pm 1 °C
Humidity : 55 %RH \pm 20 %RH
Barometric Pressure : 1013 hPa \pm 10 hPa
Received Date : 22 July 2021
Calibration Date : 31 August 2021
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18301012012	Sensodyne	21 May 2022

Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI)

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibration By :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
Mr. Pacht Matharom
Calibration Engineer Supervisor
Issue Date : 1 September 2021

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 21-AFM-095
Request No : Req-2021-0958

Result of Calibration :

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
LPM	LPM	LPM	LPM	LPM
14.5	14.508	14.54	-0.032	0.21
15.0	15.009	15.05	-0.041	0.22
15.8	15.807	15.88	-0.073	0.23
16.6	16.606	16.70	-0.094	0.24
18.3	18.308	18.41	-0.102	0.26

Note

STD : Standard

UUC : Unit Under Calibration

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.02 Issue date 03/07/19

เอกสารไม่ควบคุม

Certificate No : 21-DPM-101
Request No : Req-2021-0958

Measurement results : Barometric Pressure

Calibration Range	Barometric Pressure			
	STD Reading	UUC Reading	Correction	Uncertainty
(mmHg)	(mmHg)	(mmHg)	(mmHg)	(mmHg)
745	745.02	744.2	-0.82	±2.0
750	750.04	749.2	-0.84	±2.0
755	755.01	754.2	-0.81	±2.0
760	760.03	759.2	-0.83	±2.0
765	765.05	764.2	-0.85	±2.0

Calibration Procedure : In-house method CP-DPM-03 by Comparison With Standard Barometric Pressure

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.02 Issue date 13/02/20

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No : 21-DPM-101
Request No : Req-2021-0958

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Unit Under Calibration Details

Calibration Parameter : Barometric Pressure
Instrument Name : Air Flow Meter
Manufacturer : BGI
Model : deltaCal DC1
Serial Number : 159822
ID : UAEFPM.039/2561
Calibration Result: Without Adjustment
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 22 July 2021
Calibration Date : 31 August 2021
Calibration By : Mr. Sitichok Jirapaksasakun
Location of Calibration : LAB 4 Air Velocity

Calibration Procedure : In-house method CP-DPM-03 by Comparison With Standard Barometric Pressure

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Barometric Pressure	CPG 1400	4000KDU.651832	NIMT	2 November 2021
Thermohygrometer	SD700	Q493352	NIMT	3 October 2021

Traceability : This certificate provide traceability of measurement to recognized national standard, and to the realization of the International System of Units (SI). National Institute of Metrology (NIST)

Note : The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :
Service Calibration Engineer

Approved By :
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 1 September 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.02 Issue date 13/02/20

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No : 21-RHM-064
Request No : Req-2021-0958

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : deltaCal DC1
Serial Number : 159822
ID : UAEFPM.039/2561
Resolution : 0.1 (°C)
Sensor Model : 2182 (T0)
Sensor SN : MRG024084-001
Sensor ID : UAEFPM.039/2561
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 5 °C
Humidity : 55 %RH ± 20 %RH
Received Date : 22 July 2021
Calibration Date : 31 August 2021
Calibration By : Mr. Sitichok Jirapaksasakun
Location of Calibration : LAB 2 Temperature
Calibration Method : In-house method CP-THM-01 by Comparison With Standard Relative Humidity Meter and Standard Thermometer with RTD Probe in Humidity / Temperature Chamber

Reference Standard

Standard Thermometer Model: GT11, S/N: 12000077, Which was calibration on 30 March 2021, Calibration of Certificate No. : QR21-0719 and Relative Humidity Meter, Model: RP23-A, S/N: 61629079, Which was calibration on 28 September 2020, Calibration of Certificate No. : QR20-1651

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No. Calibration 0293

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :
Service Calibration Engineer

Approved By :
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 1 September 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-RHM-01 Rev.02 Issue date 03/07/19

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Certificate No : 21-HIM-064
Request No : Req-2021-0988

Calibration Results : Without Adjustment

Temperature Calibration : Filter Temperature (Tf)

Temperature Range (°C)	Without Adjustment (°C)			Uncertainty (°C)
	STD Reading (°C)	UUC Reading (°C)	Correction (°C)	
20	19.999	20.1	-0.101	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.3	-0.296	0.10

Temperature Calibration : Ambient Temperature (Ta)

Temperature Range (°C)	Without Adjustment (°C)			Uncertainty (°C)
	STD Reading (°C)	UUC Reading (°C)	Correction (°C)	
20	19.999	20.1	-0.101	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.3	-0.296	0.10

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

PM-201-01M (3) Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม



Cert No.: 21H803
Page: 2 of 2

Result of Calibration:

Function:

Without Adjustment
Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	43	2.9	1.6
25.0	60.0	60	0.0	1.8
25.0	80.0	79	-1.0	1.9

Result of Calibration:

Function:

Without Adjustment
Temperature measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.011	20.0	-0.011	0.72
30.019	30.0	-0.019	0.72
34.989	35.0	0.011	0.72
40.008	40.0	-0.008	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 21H803
Page: 1 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Barigo
Model :
Serial No.:
ID No.: UAE.ANV.128/2550

Condition As-Received: Used Item

Received Date: 20 March 2021

Calibration Date: 31 March 2021

Reference: 2103-1189WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10250

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31663	18540	28 Jul 2021
2) Handheld Thermometer With Sensor	1521	ASA339	201968	10 Aug 2021

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certification is traceable to the International System of Unit maintained at-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by : Kralpop Onrai
Issue Date : 20 April 2021

Approved Signatory :

[✓] Chakrit Waewenjua
[] Pornthipha Tameyakul
[] Pitak Srirongkoi

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๙ 0258330



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 21P435
Page: 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : 111MS
Serial No.:
ID No.: UAE.EMA2.067/2552

Condition As-Received: Used Item

Received Date: 01 February 2021

Calibration Date: 08 February 2021

Reference: 2102-0083WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1012 mbar

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10250

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP1142	1422505046	MP-0053-20	05 Apr 2021

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3. This result of calibration was made on requested at the point specified by customer.

4. Scale and conversion factor is 1 kPa = 7.50062 mmHg

5. This instrument was used clean air as pressure media.

6. The certificate is valid only to the item calibrated on date and place of calibration.

7. This Certification is traceable to the International System of Unit maintained at-

- National Institute of Metrology Thailand (NIMT)


Calibrated by : Nopparat Phongam
Issue Date : 11 February 2021

Approved Signatory :

[] Phalinee Pratsapaal
[] Sura Suwananasi
[✓] Attapol Panurach

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Cert.No.: 21P435
 Page: 2 of 2

Result of calibration:- Without adjustment
 Function:- Absolute Pressure Measurement
 Range: 720 mmHg to 780 mmHg
 Scale Interval: 1 mmHg (The Fifth Estimate)

Applied Pressure (mmHg)	719.48	730.76	741.39	752.01	763.14	774.66	786.96
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	0.52	-0.76	-1.39	-2.01	-3.14	-4.66	-6.96


Increasing Pressure
 Decreasing Pressure

Applied Pressure (mmHg)	786.96	774.76	762.78	751.81	740.88	730.53	719.35
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-6.96	-4.76	-2.78	-1.81	-0.88	-0.53	0.65

The uncertainty of measurement was ± 0.24 mmHg
 * UUC = Unit Under Calibration
 The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

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Cert. No.: 22H770
 Page: 2 of 2

Result of Calibration:- Without Adjustment
 Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	56.0	15.9	1.5
25.0	60.0	80.5	0.5	1.7
25.0	80.0	63.0	-17.0	1.7


Result of Calibration:- Without Adjustment
 Function: Temperature measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.02	20.0	-0.02	0.72
29.98	30.0	0.02	0.72
35.02	35.5	0.48	0.72
40.03	41.0	0.97	0.72


UUC* : Unit Under Calibration
 The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

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 a 1104142



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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 TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration
 Certificate No.: 22H770
 Page: 1 of 2


Equipment : Dial Thermo-Hygrometer
 Manufacturer: Barigo
 Model : -
 Serial No.: -
 ID No.: UAE.ANV.003/2545
 Condition As-Received: Used Item
 Received Date: 30 March 2022
 Calibration Date: 01 April 2022
 Reference: 2203-1124WSC
 Ambient Temperature: (25 \pm 3) °C
 Relative Humidity: (50 \pm 20) %
 Submitted by: United Analyst and Engineering Consultant Co., Ltd.
 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration
 1. Reference standards instruments :
 Instrument Model Serial No. Certificate No. Due Date
 1) Standard Chilled Mirror Hygrometer Sensor Dew Prime II 31863 19714 17 Sep 2022
 2) Standard Humidity/Temperature Meter 400 10203027 TH-0063-21 01 Jul 2022
 2. The certificate is valid only to the item calibrated on date and place of calibration.
 3. This Certification is traceable to the International System of Unit maintained at:-
 -National Institute of Standards and Technology (NIST) ; The United States of America
 -National Institute of Metrology Thailand (NIMT)

Calibrated by: Somchai Dumwor
 Issue Date: 08 April 2022
 Approved Signatory :
 [V] Chakrit Wawwanjua
 [] Pornthippa Tamayakul
 [] Viporn Tantiyawutti

เอกสารไม่ควบคุม
 a 0285422



United Analyst and Engineering Consultant Co., Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Nov 10, 2021

Equipment : Gas Analyzer (NO_x) Model : 42i
 Manufacturer : Thermo Scientific Serial Number : 1201497724

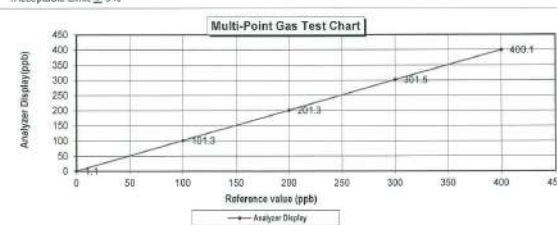
Standard Gas Concentration
 Sulphur Dioxide (SO₂) 44.75 PPM
 Nitric Oxide (NO) 45.35 PPM
 Methane (CH₄) - PPM
 Carbon Monoxide (CO) 1007 PPM
 Cylinder No. : CC1595999
 Expiration Date : Jul 30, 2022

Dilutor Detail
 Manufacturer : Thermo Scientific
 Model : 146i
 Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.1	1.18	1.10
Level 2	20.00%	100.0	101.3	1.30	1.28
Level 3	40.00%	200.0	201.3	1.30	0.65
Level 4	60.00%	300.0	301.5	1.50	0.50
Level 5	80.00%	400.0	400.1	0.10	0.02
Remark : Measuring Range : 500.0 ppb			Average Difference (%)		0.71
: Acceptable Limit \pm 5%					

Multi-Point Gas Test Chart



Signature: [Signature]
 Date: 10 Nov 2021

MULTI-POINT GAS TEST REPORT

Test Date : Nov 10, 2021

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201497725

Standard Gas Concentration

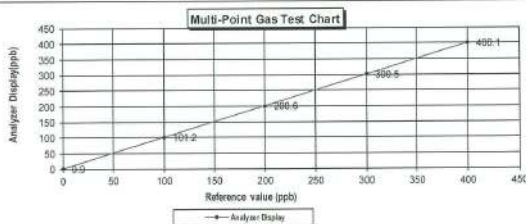
Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	101.2	1.20	1.19
Level 3	40.00%	200.0	200.6	0.60	0.30
Level 4	60.00%	300.0	300.5	0.50	0.17
Level 5	80.00%	400.0	400.1	0.10	0.02
Remark : Measuring Range			500.0 ppb	Average Difference (%)	0.52
Acceptable Limit $\pm 5\%$					



70/11/21
70/11/21

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01QC Reference Number: 160-401526192-1
Cylinder Number: CC159599 Cylinder Volume: 144.4 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12019 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO₂,BALN Certification Date: Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/9-12/011, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volumetric basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals)

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.78 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.78 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	1000 PPM	1007 PPM	G1	$\pm 0.4\%$ NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	$\pm 0.4\%$ NIST Traceable	07/23/2019, 07/30/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18090121	KAL004215	249.9 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	18090121	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	18090121	KAL004215	250.0 PPM NOX/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	18090121	KAL004307-NOX	50.03 PPM NOX/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	0141709	KAL003190	49.87 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.0\%$	Jun 20, 2022
NTRM	072508	KAL004570	570.0 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.4\%$	May 14, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO MKS FTR 000629062	FTIR	Jul 19, 2019
NO MKS FTR 000629062	FTIR	Jul 22, 2019
NO MKS FTR 000629062	FTIR	Jul 22, 2019
SO2 MKS FTR 000629062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES: RAN# 51319-CM03

PO# 5219002210

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG



Signature on file
Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : June 30, 2021

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778106

Standard Gas Concentration

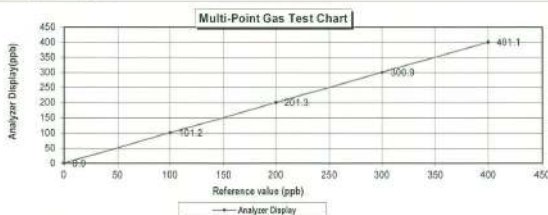
Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	101.2	1.20	1.19
Level 3	40.00%	200.0	201.3	1.30	0.65
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	401.1	1.10	0.27
Remark : Measuring Range			500.0 ppb	Average Difference (%)	0.66
Acceptable Limit $\pm 5\%$					



30/June 2021
30/June 2021

MULTI-POINT GAS TEST REPORT

Test Date : July 20, 2021

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778107

Standard Gas Concentration

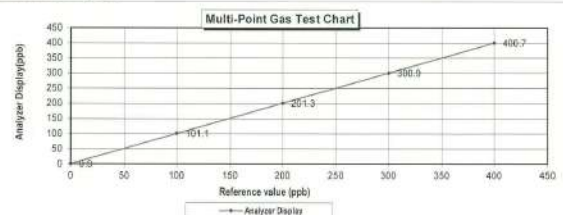
Sulphur Dioxide (SO ₂)	44.75	PPM
Nitric Oxide (NO)	45.35	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	1007	PPM
Cylinder No. :	CC159599	
Expiration Date :	Jul 30, 2022	

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	101.1	1.10	1.09
Level 3	40.00%	200.0	201.3	1.30	0.65
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.7	0.70	0.17
Remark : Measuring Range			500.0 ppb	Average Difference (%)	0.62
Acceptable Limit $\pm 5\%$					



30/July 2021
30/July 2021



MULTI-POINT GAS TEST REPORT

Test Date : Nov 22, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920012

Standard Gas Concentration

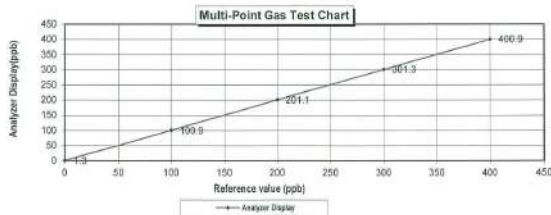
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.3	1.30	1.30
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	201.1	1.10	0.55
Level 4	60.00%	300.0	301.3	1.30	0.43
Level 5	80.00%	400.0	400.9	0.90	0.22
Remark : Measuring Range			500.0 ppb	Average Difference (%)	0.68
				Acceptable Limit ± 5%	



22.11.21
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MULTI-POINT GAS TEST REPORT

Test Date : Nov 22, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920013

Standard Gas Concentration

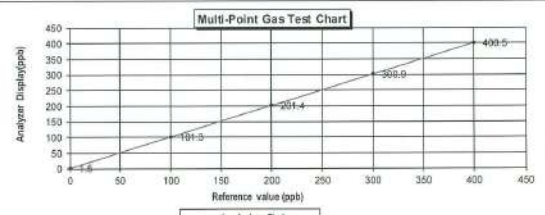
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.5	1.50	1.50
Level 2	20.00%	100.0	101.3	1.30	1.28
Level 3	40.00%	200.0	201.4	1.40	0.70
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.5	0.50	0.12
Remark : Measuring Range			500.0 ppb	Average Difference (%)	0.78
				Acceptable Limit ± 5%	



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22.11.21
22.11.2021



an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
4441 Easton Road
Bldg 1
Plumsteadville, PA 18902
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04N199E15A01QC	Reference Number:	160-401526192-1
Cylinder Number:	CC159599	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12019	Valve Outlet:	680
Gas Code:	CO,NO,NOX,SO ₂ ,BALN	Certification Date:	Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/051, using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.76 PPM	G1	±0.8% NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.78 PPM	G1	±0.8% NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	±1.1% NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	±0.4% NIST Traceable	07/23/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18050121	KAL004215	240.0 PPM NITRIC OXIDE/NITROGEN	±0.4%	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	±0.60%	Mar 12, 2024
NTRM	18050121	KAL004215	250.0 PPM NOX/NITROGEN	±0.4%	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NOX/NITROGEN	±0.80%	Mar 12, 2024
NTRM	0141708	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Jun 26, 2022
NTRM	072508	KAL004570	970.0 PPM CARBON MONOXIDE/NITROGEN	±0.4%	May 14, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
CO MKS FTR 00029062	FTIR	Jul 19, 2019
NO MKS FTR 00029062	FTIR	Jul 22, 2019
NO MKS FTR 00029062	FTIR	Jul 22, 2019
SO ₂ MKS FTR 00029062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES/RAN# 51319-CM03

PC# 5219002210

GROSS WEIGHT: 28.6 KG

NET WEIGHT: 4.1 KG



MULTI-POINT GAS TEST REPORT

Test Date : Jan 8, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920016

Standard Gas Concentration

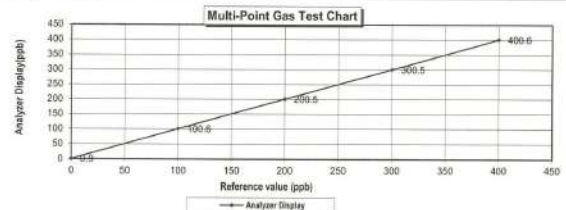
Sulphur Dioxide (SO ₂)	44.75	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007			
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.90	0.90	0.90
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.5	0.50	0.17
Level 5	80.00%	400.0	400.6	0.60	0.15
Remark : Measuring Range			500.0 ppb	Average Difference (%)	0.41
				Acceptable Limit ± 5%	



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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01QC Reference Number: 160-401526192-1
Cylinder Number: CC159599 Cylinder Volume: 144.4 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12019 Valve Outlet: 660
Gas Code: CQ,NO,NOX,SO2,BALN Certification Date: Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/9-12/051, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volumetric basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals)

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.76 PPM	G1	±0.8% NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.76 PPM	G1	±0.8% NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	45.00 PPM	45.35 PPM	G1	±1.1% NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	±0.4% NIST Traceable	07/23/2019
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18090121	KAL004215	249.9 PPM NITRIC OXIDE/NITROGEN	±0.4%	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	±0.86%	Mar 12, 2024
NTRM	18090121	KAL004215	250.0 PPM NOX/NITROGEN	±0.4%	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NOX/NITROGEN	±0.86%	Mar 12, 2024
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Jun 20, 2022
NTRM	072308	KAL004570	970.0 PPM CARBON MONOXIDE/NITROGEN	±0.4%	May 14, 2021

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO MKS FTIR 000929052	FTIR	Jul 19, 2019
NO MKS FTIR 000929052	FTIR	Jul 22, 2019
NO MKS FTIR 000929052	FTIR	Jul 22, 2019
SO2 MKS FTIR 000929052	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES: RAN# 51319-CM03
PO# 5219002210
GROSS WEIGHT: 28.6 KG
NET WEIGHT: 4.1 KG



Signature on file
Approved for Release

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1200636464

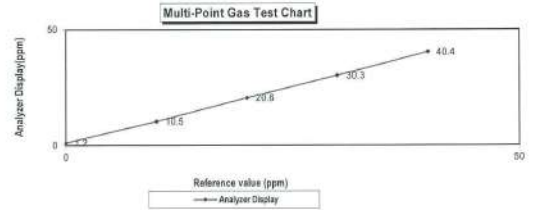
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CC159599	
Expiration Date : Jul 30, 2022	

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.2	1.2	1.2
Level 2	20.00%	10.0	10.5	0.5	4.8
Level 3	40.00%	20.0	20.5	0.6	2.9
Level 4	60.00%	30.0	30.3	0.3	1.0
Level 5	80.00%	40.0	40.4	0.4	1.0

Remark : Measuring Range 50.0 ppm
Acceptable Limit ± 5%

Average Difference (%) 2.17



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24 Nov 2021

24 Nov 2021

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : June 14, 2021

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo Scientific Serial Number : 1201778111

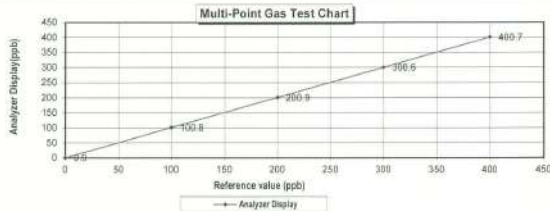
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CC159599	
Expiration Date : Jul 30, 2022	

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90
Level 2	20.00%	100.0	100.8	0.80	0.79
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.6	0.60	0.20
Level 5	80.00%	400.0	400.7	0.70	0.17

Remark : Measuring Range 500.0 ppb
Acceptable Limit ± 5%

Average Difference (%) 0.50



14 June 2021

14 June 2021

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1200636465

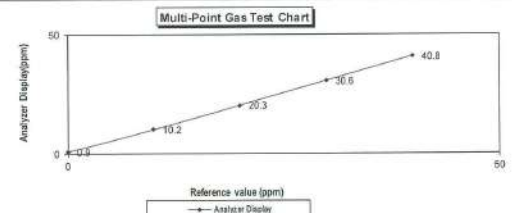
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.75 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.35 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 1007 PPM	
Cylinder No. : CC159599	
Expiration Date : Jul 30, 2022	

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	10.0	10.2	0.2	2.0
Level 3	40.00%	20.0	20.3	0.3	1.5
Level 4	60.00%	30.0	30.6	0.6	2.0
Level 5	80.00%	40.0	40.8	0.8	2.0

Remark : Measuring Range 50.0 ppm
Acceptable Limit ± 5%

Average Difference (%) 1.85



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24 Nov 2021

24 Nov 2021

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Mar 05, 2021

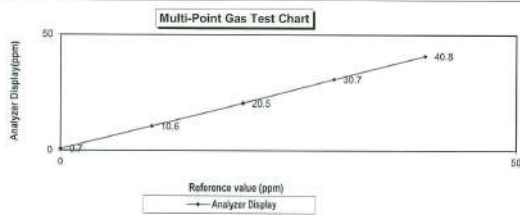
Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1182920018

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.7	0.7	0.7
Level 2	20.00%	10.0	10.6	0.6	5.7	5.7
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3	2.3
Level 5	80.00%	40.0	40.8	0.8	2.0	2.0
Remark : Measuring Range			50.0 ppm	Average Difference (%)		2.61



Calculate by
5/03/21
5/14/21

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A01QC Reference Number: 160-401526192-1
Cylinder Number: CC159599 Cylinder Volume: 144.4 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12019 Valve Outlet: 660
Gas Code: CO, NO, NOX, SO₂, BALN Certification Date: Jul 30, 2019

Expiration Date: Jul 30, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/9-12/011, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volumetric basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals)

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.78 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
NITRIC OXIDE	45.00 PPM	44.78 PPM	G1	$\pm 0.8\%$ NIST Traceable	07/23/2019, 07/30/2019
SULFUR DIOXIDE	1000 PPM	45.35 PPM	G1	$\pm 1\%$ NIST Traceable	07/23/2019, 07/30/2019
CARBON MONOXIDE	1000 PPM	1007 PPM	G1	$\pm 0.4\%$ NIST Traceable	07/23/2019
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	18090121	KAL004215	249.8 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL004307	50.03 PPM NITRIC OXIDE/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	18060121	KAL004215	250.8 PPM NOX/NITROGEN	$\pm 0.4\%$	Nov 08, 2023
NTRM	052411	KAL004307-NOX	50.03 PPM NOX/NITROGEN	$\pm 0.80\%$	Mar 12, 2024
NTRM	0141709	KAL003190	49.87 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.9\%$	Jun 20, 2022
NTRM	072508	KAL004570	570.0 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.4\%$	May 14, 2021

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO MKS FTIR 000629062	FTIR	Jul 19, 2019
NO MKS FTIR 000629062	FTIR	Jul 22, 2019
NO MKS FTIR 000629062	FTIR	Jul 22, 2019
SO2 MKS FTIR 000629062	FTIR	Jul 22, 2019

Triad Data Available Upon Request

NOTES: RAN# 51319-CM03
PC# 5219002210
GROSS WEIGHT: 28.6 KG
NET WEIGHT: 4.1 KG



Signature on file
Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Mar 3, 2021

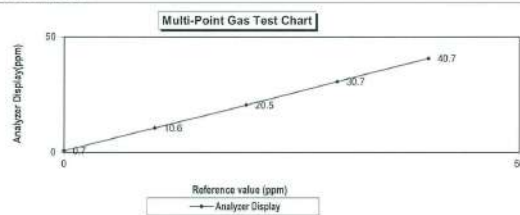
Equipment : Gas Analyzer (CO) Model : 48C
Manufacturer : Thermo Environmental Instruments Serial Number : 48C-62460-335/5

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.75 PPM
Nitric Oxide (NO) 45.35 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 1007 PPM
Cylinder No. : CC159599
Expiration Date : Jul 30, 2022

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.7	0.7
Level 2	20.00%	10.0	10.6	0.6	5.7
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.7	0.7	1.7
Remark : Measuring Range			50.0 ppm		
			Average Difference (%)		
			2.56		



Calculate by
5/03/21
5/14/21

MULTI-POINT GAS TEST REPORT

Test Date : July 16, 2021

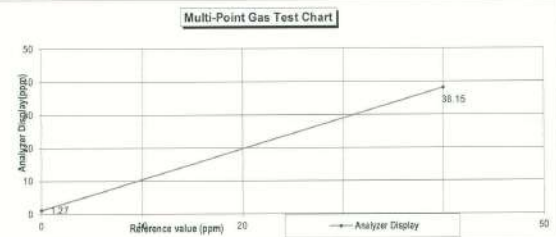
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : 93JNLMN9

Standard Gas Concentration
Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.27	1.27	1.27	1.27
Level 2	80.00%	40.00	38.15	-1.85	-4.85	4.85
Remark : Measuring Range			50.00 ppm	Average Difference (%)		3.06



Calculate by
16/07/2021
16/07/2021

MULTI-POINT GAS TEST REPORT

Test Date : Sep 16, 2020

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : 933N1MN9

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	-	PPM
Nitric Oxide (NO)	-	PPM
Methane (CH ₄)	39.8	PPM
Carbon Monoxide (CO)	-	PPM
Cylinder No. :	D824432	
Expiration Date :	Aug 4, 2028	

Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	0.27	0.27	0.27
Level 2 80.00%	40.00	37.95	-2.05	-5.40
Remark : Measuring Range 50.00 ppm		Average Difference (%) 2.84		

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

16, Sep, 2020 16, Sep, 2020

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E03A99E15A006C Reference Number: 160-401908379-1
Cylinder Number: CC143232 Cylinder Volume: 144.0 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2016 PSIG
PGVP Number: A12020 Valve Outlet: 590
Gas Code: CH4,PPN,BALA Certification Date: Oct 16, 2020
Expiration Date: Oct 16, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a brief analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder Below 100 ppm, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	4000 PPM	4019 PPM	G1	+/- 1.5% NIST Traceable	10/16/2020
PROPANE	4000 PPM	4008 PPM	G1	+/- 0.7% NIST Traceable	10/09/2020
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	02010405	R010090	4978 PPM PROPANE/NITROGEN	+/- 0.8%	Dec 02, 2021
NTRM	170608	CC160290	0.997 % METHANE/NITROGEN	+/- 0.4%	Aug 22, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CH4 - 000525781	FTIR	Oct 14, 2020
Nicolet 6700 APV1100391 C3H8	FTIR	Sep 18, 2020

Triad Data Available Upon Request
NOTES-NET WEIGHTS: 4.965kg
GROSS WEIGHTS: 27.356kg
PO#: 622003825

Approved for Release

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : June 9, 2021

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : KWWV1R96

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	-	PPM
Nitric Oxide (NO)	-	PPM
Methane (CH ₄)	39.8	PPM
Carbon Monoxide (CO)	-	PPM
Cylinder No. :	D824432	
Expiration Date :	Aug 4, 2028	

Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	1.75	1.75	1.75
Level 2 80.00%	40.00	39.15	-0.85	-2.17
Remark : Measuring Range 50.00 ppm		Average Difference (%) 1.96		

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

10, June, 2021 16, June, 2021

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Sep 29, 2020

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : KWWV1R96

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	-	PPM
Nitric Oxide (NO)	-	PPM
Methane (CH ₄)	39.8	PPM
Carbon Monoxide (CO)	-	PPM
Cylinder No. :	D824432	
Expiration Date :	Aug 4, 2028	

Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.00	0.35	0.35	0.35
Level 2 80.00%	40.00	39.35	-0.65	-1.65
Remark : Measuring Range 50.00 ppm		Average Difference (%) 1.00		

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

30, Sep, 2020 30, Sep, 2020

เอกสารไม่ควบคุม

Calibration Certificate

Part Number: 721A2601
Description: Micromate with DIN Geophone
Serial Number: UM11060
Calibration Date: June 25, 2021
Calibration Reference Equipment: SRV-AFR 714J7401

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

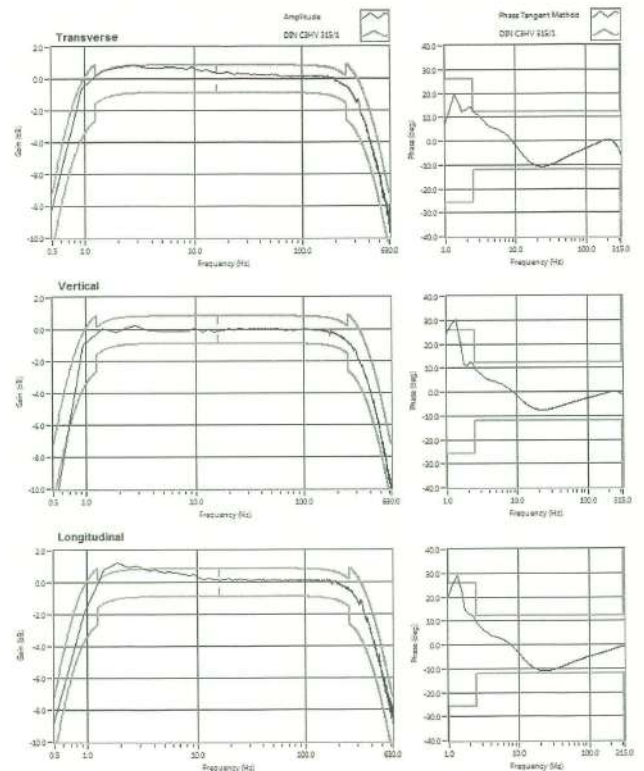
The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By: 
Tuyen Bui

 309 Leggett Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642

Frequency Response of UM11060 (As Found)

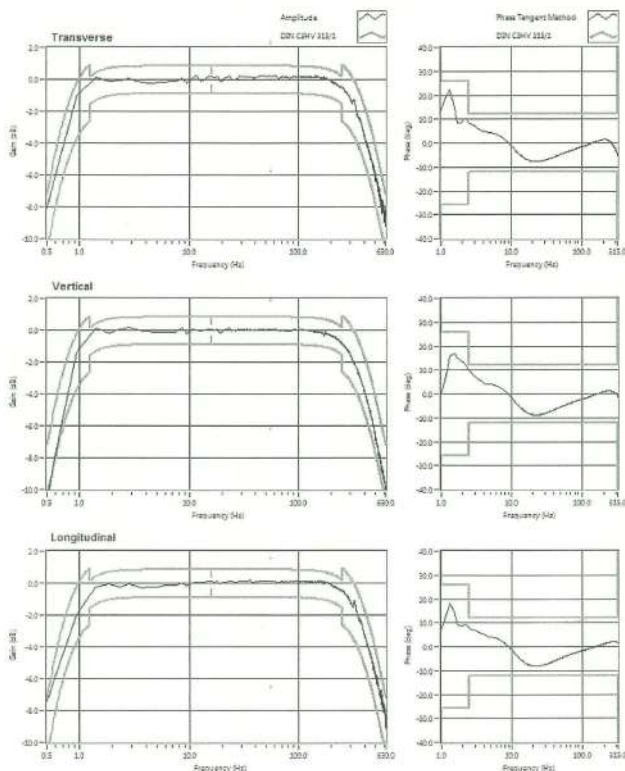


Monday, May 31, 2021

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Frequency Response of UM11060



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Pongkarn 29 Year 4, Pongkarn Rd., Ladprao, Bangkok 10220
Tel: 02-578-0253-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: cal@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11355/UM11355
CLID. NO. : 252000637
JOB CONTROL NO. : 210416034735

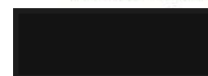
CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 16 April 2021

DATE OF ISSUED : 21 April 2021

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
21 April 2021



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q21034735

F3-011-04/01-12

page 1 of 4

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม





REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11355/UM11355
DATE OF CALIBRATION : 19 April 2021

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 according to ISO 16063-21 as calibration guideline.
The calibration was performed by using Digital Multimeter, High Resolution Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Digital Multimeter, Hewlett Packard Model 34401A S/N: 3146A75935.
- High Resolution Programmable Timer/Counter, Philips Model PM6680B S/N: SM607101.
- Accelerometer with Measuring Amplifier, Briel & Kjaer Model 8305, 2525 S/N: 397018, 2434988.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0138-20, Due Date 21 September 2021.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0002/21, Due Date 04 January 2022.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0047-20, Due Date 05 November 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2.00 which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21034735

F3-011-04/01-12

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เอกสารไม่ควบคุม



@calibration



CALIBRATION DATA

*3. DISPLACEMENT RESULT

Test point	Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)	(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	0.030	0.030	0.000	2.2
0.04	50 Hz	0.040	0.040	0.000	1.8
0.05	50 Hz	0.050	0.049	+0.001	1.5
0.06	50 Hz	0.060	0.058	+0.002	1.3
0.07	50 Hz	0.070	0.068	+0.002	1.2
0.03	100 Hz	0.030	0.030	0.000	2.2
0.04	100 Hz	0.040	0.040	0.000	1.8
0.05	100 Hz	0.050	0.050	0.000	1.5
0.06	100 Hz	0.060	0.059	+0.001	1.3
0.07	100 Hz	0.070	0.069	+0.001	1.2

Note: * means Calibrations marked "Not ANAB Accredited" in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 006 Page 1 of 57

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q21034735

F3-011-04/01-12

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เอกสารไม่ควบคุม



@calibration



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point	Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)	(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	0.300	0.298	+0.002	2.5
0.4	50 Hz	0.400	0.396	+0.004	2.0
0.5	50 Hz	0.500	0.495	+0.005	1.9
0.6	50 Hz	0.600	0.593	+0.007	1.3
0.7	50 Hz	0.700	0.692	+0.008	1.3
0.3	100 Hz	0.300	0.296	+0.004	2.5
0.4	100 Hz	0.400	0.394	+0.006	2.0
0.5	100 Hz	0.500	0.491	+0.009	1.9
0.6	100 Hz	0.600	0.588	+0.012	1.3
0.7	100 Hz	0.700	0.683	+0.017	1.3

2. VELOCITY RESULT

Test point	Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)	(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	3.080	2.962	+0.038	3.7
4	50 Hz	4.000	3.941	+0.059	2.8
5	50 Hz	5.000	4.913	+0.087	2.3
6	50 Hz	6.000	5.898	+0.102	2.0
7	50 Hz	7.000	6.862	+0.138	1.8
3	100 Hz	3.080	2.960	+0.040	3.7
4	100 Hz	4.000	3.935	+0.065	2.8
5	100 Hz	5.000	4.903	+0.097	2.3
6	100 Hz	6.000	5.888	+0.112	2.0
7	100 Hz	7.000	6.850	+0.150	1.8

Certificate No. Q21034735

F3-011-04/01-12

page 3 of 4

เอกสารไม่ควบคุม



@calibration

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/131 MOO 13, SOI SUTINAGORN 11 TAMBON BANG KARD,
AMPHOE BANG PHEI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 06649-2116-5800-1 FAX: 06649-2115-7149



Page 1 of 2

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sakthamvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 21-ACT-187

Request No : Req-2021-0523

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73249
ID : UAE.EFM.105/2561

Class : 1

Range : 94 - 114 dB / 1000 Hz

Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 27 April 2021
Calibration Date : 28 May 2021

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	14 May 2022
THD Multimeter	2015	1047765	NIMT	22 January 2022

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
Mr. Pait Mathavorn
Calibration Engineer Supervisor

Issue Date : 28 May 2021

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory Co., Ltd.

เอกสารไม่ควบคุม

File: 2021-05-28 09:00:00 Issue 004

Certificate No : 21-ACT-187
Request No : Req-2021-0523

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.81	-0.19	-	-	0.11	0.25
114 dB / 1000 Hz	113.83	-0.17	-	-	0.11	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.97	0.003	-	-	0.02	0.70
114 dB / 1000 Hz	999.98	0.002	-	-	0.02	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.18		-		0.17	2.5
114 dB / 1000 Hz	0.04		-		0.17	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibration pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
Page 2 of 2

เอกสารไม่ควบคุม

Certificate No : 21-ACT-327
Request No : Req-2021-0995

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.10	0.10	-	-	0.12	0.40
114 dB / 1000 Hz	114.12	0.12	-	-	0.11	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.10	1.7
114 dB / 1000 Hz	1000.00	0.00	-	-	0.10	1.7

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.04		-		0.40	3.0
114 dB / 1000 Hz	0.21		-		0.40	3.0

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibration pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
Page 2 of 2

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak,
Prakanong, Bangkok 10260

Certificate No : 21-ACT-327
Request No : Req-2021-0995

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL150
Serial Number : 6171
ID : UAE.EFM.117/2562
Class : 2
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 22 July 2021
Calibration Date : 24 August 2021
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	14 May 2022
THD Multimeter	2015	1047765	NIMT	21 January 2022

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k=2, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 24 August 2021

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
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เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 22-ACT-034
Request No : Req-2022-0092

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LaT2
Serial Number : 0005394
ID : UAE.EFM.031/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329261
Preamplifier Model : PRMLxT2C
Preamplifier S/N : 073810
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSM
Audio Generator	Svante	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Calibration Officer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 21 January 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
Page 1 of 1

เอกสารไม่ควบคุม

Certificate No : 22-ACT-034
Request No : Req-2022-0092

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.85	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
A	27.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
A	27.5	0.10
C	27.0	0.10
Z	31.8	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A	C	Z	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	0.0	0.1	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.3	0.2	0.60	3.0
8000 Hz	-0.3	-0.3	-0.3	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing and/or Accrediting Body.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-034
Request No : Req-2022-0092

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	(± dB)	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
139.00	139	139.0	0.0		1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	93.9	-0.1		1.1
89.00	89	88.9	-0.1		1.1
84.00	84	83.9	-0.1		1.1
79.00	79	78.9	-0.1		1.1
74.00	74	73.9	-0.1		1.1
69.00	69	69.0	0.0		1.1
64.00	64	63.9	-0.1		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		0.8
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.3	0.3		1.1
29.00	29	29.5	0.5		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing and/or Accrediting Body.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-034
Request No : Req-2022-0092

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A	C	Z	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
63 Hz	-0.2	-0.1	0.0		2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	-0.1	0.0		5
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	(± dB)	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	(± dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0		0.1
Log	114.00	114.0	0.0		0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing and/or Accrediting Body.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-034
Request No : Req-2022-0092

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(± dB)	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	42.8	43.0	0.2		1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Timeburst	Ref	UUC	ERR	(± dB)	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	200	135.0	135.0	0.0		1
	2	118.0	117.7	-0.3		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.9	-0.1		+1.0, -5.0
SEL	200	129.0	129.0	0.0		1
	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
Complete cycle	137.4	136.8	-0.60		3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing and/or Accrediting Body.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-034
Request No : Req-2022-0992

12. Overload Indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.8		
Final	138.6		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0994

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	Adjust	UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
1000 Hz 114.00 dB	113.85	114.0	+0.15	113.9	0.05
				0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	28.1	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	27.9	0.10
C	27.3	0.10
Z	31.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve		Limit
STD Setting	A (dB) C (dB) Z (dB)	(± dB)	(± dB)
125 Hz	0.0 0.0 0.0	0.50	2.0
1000 Hz	0.0 0.0 0.0	0.60	1.0
4000 Hz	0.4 0.3 0.3	0.60	3.0
8000 Hz	-0.1 -0.2 -0.1	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udonnong 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 22-ACT-035
Request No : Req-2022-0994

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LaT2
Serial Number : 0005398
ID : UAEFM.035/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone SN : 328675
Preamplifier Model : PRMLAT2C
Preamplifier SN : 073793
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 19 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3: 2013 Electromechanics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000254	14 June 2022	TSI
Audio Generator	Svante	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :
Mr. Noppadol Luangart
Calibration Officer

Approved By :
Mr. Pachi Mahavorn
Calibration Engineer Supervisor
Issue Date : 21 January 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0994

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve		Limit
STD Setting	A (dB) C (dB) Z (dB)	(± dB)	(± dB)
63 Hz	-0.2 -0.1 -0.1		2.0
125 Hz	-0.1 0.0 -0.1		1.5
250 Hz	-0.1 0.0 -0.1		1.5
500 Hz	-0.1 0.0 -0.1		1.5
1000 Hz	0.0 0.0 0.0	0.2	1.0
2000 Hz	0.0 0.0 0.0		2.0
4000 Hz	0.0 0.0 0.0		3.0
8000 Hz	-0.1 -0.1 0.0		5
16000 Hz	-0.1 -0.1 -0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Leq	114.00	114.0	0.0	0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-033
Request No : Req-2022-0094

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)
139.00	139	139.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	99.0	0.0	1.1
94.00	94	93.9	-0.1	1.1
89.00	89	88.9	-0.1	1.1
84.00	84	83.9	-0.1	1.1
79.00	79	78.9	-0.1	1.1
74.00	74	73.9	-0.1	1.1
69.00	69	69.0	0.0	1.1
64.00	64	63.9	-0.1	1.1
59.00	59	59.0	0.0	1.1
54.00	54	54.0	0.0	1.1
49.00	49	49.0	0.0	0.8
44.00	44	44.1	0.1	1.1
39.00	39	39.3	0.3	1.1
34.00	34	34.3	0.3	1.1
29.00	29	29.5	0.5	1.1

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-033
Request No : Req-2022-0094

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.3		
Negative one-half cycle	142.6		
Deviated	0.3	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-033
Request No : Req-2022-0094

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	43.2	43.4	0.2	1.1
	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	125.0	125.0	0.0	1
	2	118.0	117.9	-0.1	+1.0, -2.5
	0.25	109.0	108.7	-0.3	+1.5, -5.0
Slow	200	128.6	128.5	-0.1	1
	2	109.0	108.9	-0.1	+1.0, -5.0
	200	129.0	129.0	0.0	1
SEL	2	109.0	109.1	+0.1	+1.0, -2.5
	0.25	100.0	99.9	-0.1	+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.1	-0.30	2.0
Negative half cycle	136.4	136.1	-0.30	2.0

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.
เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2021000506

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonwuk 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2

Serial Number 0005408

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.6378

Technician Ron Harris

Calibration Date 15 Jan 2021

Temperature 23.08 °C ± 0.26 °C

Humidity 52.9 %RH ± 2.0 %RH

Static Pressure 87.56 kPa ± 0.13 kPa

Evaluation Method

Tested electrically using Larson Davis PRLxT2C S/N 073810 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.6384.

IEC 60661-2001 Type 2

IEC 60804-2000 Type 2

IEC 61252-2002

IEC 61672-2013 Class 2

IEC 61260-2001 Class 2

ANSI S1.4-2014 Class 2

ANSI S1.1 (R2006) Type 2

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 2

ANSI S1.11 (R2009) Class 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

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LARSON DAVIS
A PCB PIEZOTRONICS DIV.

D0001.6407 Rev E

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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS360 Ultra Low Distortion Generator	2020-08-19	2021-08-19	007167

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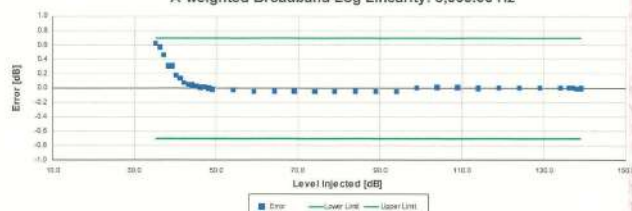
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A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60504:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 5.9, ANSI S1.4-2014 Part 1: 5.8, ANSI S1.43 (R2007) 9.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
35.00	0.83	-0.70	0.70	0.16	Pass
36.00	0.57	-0.70	0.70	0.16	Pass
37.00	0.47	-0.70	0.70	0.16	Pass
38.00	0.31	-0.70	0.70	0.16	Pass
39.00	0.31	-0.70	0.70	0.16	Pass
40.00	0.18	-0.70	0.70	0.16	Pass
41.00	0.14	-0.70	0.70	0.16	Pass
42.00	0.08	-0.70	0.70	0.16	Pass
43.00	0.06	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.03	-0.70	0.70	0.16	Pass
46.00	0.01	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.01	-0.70	0.70	0.16	Pass
50.00	-0.02	-0.70	0.70	0.16	Pass
51.00	-0.05	-0.70	0.70	0.16	Pass
52.00	-0.04	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.04	-0.70	0.70	0.16	Pass
57.00	-0.04	-0.70	0.70	0.16	Pass
58.00	-0.05	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
60.00	-0.04	-0.70	0.70	0.16	Pass
61.00	-0.04	-0.70	0.70	0.16	Pass
62.00	-0.05	-0.70	0.70	0.16	Pass
63.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
65.00	-0.04	-0.70	0.70	0.16	Pass
66.00	-0.04	-0.70	0.70	0.16	Pass
67.00	-0.04	-0.70	0.70	0.16	Pass
68.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
70.00	-0.04	-0.70	0.70	0.16	Pass
71.00	-0.04	-0.70	0.70	0.16	Pass
72.00	-0.04	-0.70	0.70	0.16	Pass
73.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.04	-0.70	0.70	0.16	Pass
75.00	-0.04	-0.70	0.70	0.16	Pass
76.00	-0.04	-0.70	0.70	0.16	Pass
77.00	-0.04	-0.70	0.70	0.16	Pass
78.00	-0.04	-0.70	0.70	0.16	Pass
79.00	-0.04	-0.70	0.70	0.16	Pass
80.00	-0.04	-0.70	0.70	0.16	Pass
81.00	-0.04	-0.70	0.70	0.16	Pass
82.00	-0.04	-0.70	0.70	0.16	Pass
83.00	-0.04	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
85.00	-0.04	-0.70	0.70	0.16	Pass
86.00	-0.04	-0.70	0.70	0.16	Pass
87.00	-0.04	-0.70	0.70	0.16	Pass
88.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
90.00	-0.04	-0.70	0.70	0.16	Pass
91.00	-0.04	-0.70	0.70	0.16	Pass
92.00	-0.04	-0.70	0.70	0.16	Pass
93.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
95.00	-0.04	-0.70	0.70	0.16	Pass
96.00	-0.04	-0.70	0.70	0.16	Pass
97.00	-0.04	-0.70	0.70	0.16	Pass
98.00	-0.04	-0.70	0.70	0.16	Pass
99.00	-0.04	-0.70	0.70	0.16	Pass
100.00	-0.04	-0.70	0.70	0.16	Pass
101.00	-0.04	-0.70	0.70	0.16	Pass
102.00	-0.04	-0.70	0.70	0.16	Pass
103.00	-0.04	-0.70	0.70	0.16	Pass
104.00	-0.04	-0.70	0.70	0.16	Pass
105.00	-0.04	-0.70	0.70	0.16	Pass
106.00	-0.04	-0.70	0.70	0.16	Pass
107.00	-0.04	-0.70	0.70	0.16	Pass
108.00	-0.04	-0.70	0.70	0.16	Pass
109.00	-0.04	-0.70	0.70	0.16	Pass
110.00	-0.04	-0.70	0.70	0.16	Pass
111.00	-0.04	-0.70	0.70	0.16	Pass
112.00	-0.04	-0.70	0.70	0.16	Pass
113.00	-0.04	-0.70	0.70	0.16	Pass
114.00	-0.04	-0.70	0.70	0.16	Pass
115.00	-0.04	-0.70	0.70	0.16	Pass
116.00	-0.04	-0.70	0.70	0.16	Pass
117.00	-0.04	-0.70	0.70	0.16	Pass
118.00	-0.04	-0.70	0.70	0.16	Pass
119.00	-0.04	-0.70	0.70	0.16	Pass
120.00	-0.04	-0.70	0.70	0.16	Pass
121.00	-0.04	-0.70	0.70	0.16	Pass
122.00	-0.04	-0.70	0.70	0.16	Pass
123.00	-0.04	-0.70	0.70	0.16	Pass
124.00	-0.04	-0.70	0.70	0.16	Pass
125.00	-0.04	-0.70	0.70	0.16	Pass
126.00	-0.04	-0.70	0.70	0.16	Pass
127.00	-0.04	-0.70	0.70	0.16	Pass
128.00	-0.04	-0.70	0.70	0.16	Pass
129.00	-0.04	-0.70	0.70	0.16	Pass
130.00	-0.04	-0.70	0.70	0.16	Pass
131.00	-0.04	-0.70	0.70	0.16	Pass
132.00	-0.04	-0.70	0.70	0.16	Pass
133.00	-0.04	-0.70	0.70	0.16	Pass
134.00	-0.04	-0.70	0.70	0.16	Pass
135.00	-0.04	-0.70	0.70	0.16	Pass
136.00	-0.04	-0.70	0.70	0.16	Pass

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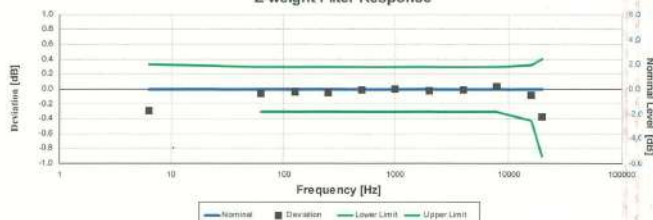
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Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60604:2000 5, ANSI S1.4:1983 (R2006) 5.1 and 6.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.29	-0.29	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.16	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass



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-- End of measurement results --

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.91	133.45	135.45	0.15
		Positive Pulse	134.91	133.44	135.44	0.15
136.95	30	Negative Pulse	133.99	133.45	135.45	0.15
		Positive Pulse	133.98	133.44	135.44	0.15

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.95	3	OVL	±1.00	0.15 ±	Pass
	5	OVL	±1.00	0.15 ±	Pass
125.95	3	-0.13	±1.00	0.15 ±	Pass
	5	-0.13	±1.00	0.15 ±	Pass
115.95	3	-0.13	±1.00	0.15 ±	Pass
	5	-0.12	±1.00	0.15 ±	Pass
105.95	3	-0.12	±1.00	0.15 ±	Pass
	5	-0.11	±1.00	0.15 ±	Pass

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.95	3	OVL	±1.00	0.15 ±	Pass
	5	OVL	±1.00	0.15 ±	Pass
125.95	3	-0.12	±1.00	0.15 ±	Pass
	5	-0.12	±1.00	0.15 ±	Pass
115.95	3	-0.13	±1.00	0.15 ±	Pass
	5	-0.12	±1.00	0.15 ±	Pass
105.95	3	-0.13	±1.00	0.15 ±	Pass
	5	-0.13	±1.00	0.15 ±	Pass

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.89	94.09	0.15	Pass
0 dB Gain, Linearity	40.26	39.39	40.79	0.16	Pass
OBA Low Range	93.99	93.89	94.09	0.15	Pass
OBA Normal Range	93.99	93.20	94.80	0.15	Pass



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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	25.90	36.00	Pass
C-weight Noise Floor	26.98	35.00	Pass
Z-weight Noise Floor	32.92	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.47	134.15	135.75	0.15	Pass
THD	-64.33	-58.00	-58.00	0.01 ±	Pass
THD+N	-60.99	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--

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-- End of Report--

Signature: *Ron Harris*

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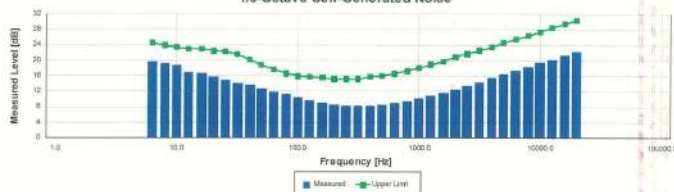
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.71	24.60	Pass
8.00	19.34	24.00	Pass
10.00	18.75	23.50	Pass
12.50	17.00	23.00	Pass
16.00	16.72	22.90	Pass
20.00	15.71	22.40	Pass
25.00	14.94	21.50	Pass
31.50	14.19	20.20	Pass
40.00	13.73	19.80	Pass
50.00	12.67	18.80	Pass
63.00	11.95	17.60	Pass
80.00	11.33	16.60	Pass
100.00	10.46	15.90	Pass
125.00	9.87	15.70	Pass
160.00	9.05	15.50	Pass
200.00	8.69	15.20	Pass
250.00	8.31	15.20	Pass
315.00	8.29	15.20	Pass
400.00	8.36	15.70	Pass
500.00	8.54	16.00	Pass
630.00	9.01	16.60	Pass
800.00	9.58	17.30	Pass
1,000.00	10.24	18.10	Pass
1,250.00	10.97	18.90	Pass
1,600.00	11.71	19.80	Pass
2,000.00	12.57	20.80	Pass
2,500.00	13.44	21.70	Pass
3,150.00	14.42	22.60	Pass
4,000.00	15.46	23.50	Pass
5,000.00	16.46	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.28	26.50	Pass
10,000.00	19.39	27.40	Pass
12,500.00	20.29	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.32	30.40	Pass

-- End of measurement results--

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Calibration Certificate

Certificate Number 2021000734

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonrak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2

Serial Number 0005407

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378

Technician Ron Harris

Calibration Date 21 Jan 2021

Calibration Due

Temperature 23.47 °C ± 0.25 °C

Humidity 52.8 %RH ± 2.0 %RH

Static Pressure 86.25 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRLxT2C S/N 073802 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8344:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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Certificate Number 2021000734

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2020-05-12	2021-05-12	006943
SRS DS360 Ultra Low Distortion Generator	2020-08-19	2021-08-19	007167

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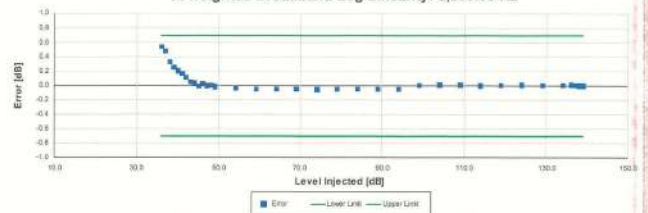
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Certificate Number 2021000734

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804-2000 6.2, IEC 61262-2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.8, ANSI S1.4S (R2007) 9.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.54	-0.70	0.70	0.16	Pass
37.00	0.48	-0.70	0.70	0.16	Pass
38.00	0.33	-0.70	0.70	0.16	Pass
39.00	0.25	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.17	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.06	-0.70	0.70	0.17	Pass
44.00	0.04	-0.70	0.70	0.17	Pass
45.00	0.00	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.01	-0.70	0.70	0.16	Pass
50.00	-0.03	-0.70	0.70	0.16	Pass
51.00	-0.05	-0.70	0.70	0.16	Pass
52.00	-0.04	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.04	-0.70	0.70	0.16	Pass
56.00	0.01	-0.70	0.70	0.15	Pass
57.00	0.01	-0.70	0.70	0.15	Pass
58.00	0.00	-0.70	0.70	0.15	Pass
59.00	0.00	-0.70	0.70	0.15	Pass
60.00	0.01	-0.70	0.70	0.15	Pass
61.00	0.01	-0.70	0.70	0.15	Pass
62.00	0.01	-0.70	0.70	0.15	Pass
63.00	0.01	-0.70	0.70	0.15	Pass
64.00	0.01	-0.70	0.70	0.15	Pass
65.00	0.01	-0.70	0.70	0.15	Pass
66.00	0.01	-0.70	0.70	0.15	Pass
67.00	0.01	-0.70	0.70	0.15	Pass
68.00	0.01	-0.70	0.70	0.15	Pass
69.00	0.01	-0.70	0.70	0.15	Pass
70.00	0.01	-0.70	0.70	0.15	Pass
71.00	0.01	-0.70	0.70	0.15	Pass
72.00	0.01	-0.70	0.70	0.15	Pass
73.00	0.01	-0.70	0.70	0.15	Pass
74.00	0.01	-0.70	0.70	0.15	Pass
75.00	0.01	-0.70	0.70	0.15	Pass
76.00	0.01	-0.70	0.70	0.15	Pass
77.00	0.01	-0.70	0.70	0.15	Pass
78.00	0.01	-0.70	0.70	0.15	Pass
79.00	0.01	-0.70	0.70	0.15	Pass
80.00	0.01	-0.70	0.70	0.15	Pass
81.00	0.01	-0.70	0.70	0.15	Pass
82.00	0.01	-0.70	0.70	0.15	Pass
83.00	0.01	-0.70	0.70	0.15	Pass
84.00	0.01	-0.70	0.70	0.15	Pass
85.00	0.01	-0.70	0.70	0.15	Pass
86.00	0.01	-0.70	0.70	0.15	Pass
87.00	0.01	-0.70	0.70	0.15	Pass
88.00	0.01	-0.70	0.70	0.15	Pass
89.00	0.01	-0.70	0.70	0.15	Pass
90.00	0.01	-0.70	0.70	0.15	Pass
91.00	0.01	-0.70	0.70	0.15	Pass
92.00	0.01	-0.70	0.70	0.15	Pass
93.00	0.01	-0.70	0.70	0.15	Pass
94.00	0.01	-0.70	0.70	0.15	Pass
95.00	0.01	-0.70	0.70	0.15	Pass
96.00	0.01	-0.70	0.70	0.15	Pass
97.00	0.01	-0.70	0.70	0.15	Pass
98.00	0.01	-0.70	0.70	0.15	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
100.00	0.01	-0.70	0.70	0.15	Pass
101.00	0.01	-0.70	0.70	0.15	Pass
102.00	0.01	-0.70	0.70	0.15	Pass
103.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
105.00	0.01	-0.70	0.70	0.15	Pass
106.00	0.01	-0.70	0.70	0.15	Pass
107.00	0.01	-0.70	0.70	0.15	Pass
108.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
110.00	0.01	-0.70	0.70	0.15	Pass
111.00	0.01	-0.70	0.70	0.15	Pass
112.00	0.01	-0.70	0.70	0.15	Pass
113.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.01	-0.70	0.70	0.15	Pass
115.00	0.01	-0.70	0.70	0.15	Pass
116.00	0.01	-0.70	0.70	0.15	Pass
117.00	0.01	-0.70	0.70	0.15	Pass
118.00	0.01	-0.70	0.70	0.15	Pass
119.00	0.01	-0.70	0.70	0.15	Pass
120.00	0.01	-0.70	0.70	0.15	Pass
121.00	0.01	-0.70	0.70	0.15	Pass
122.00	0.01	-0.70	0.70	0.15	Pass
123.00	0.01	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
125.00	0.01	-0.70	0.70	0.15	Pass
126.00	0.01	-0.70	0.70	0.15	Pass
127.00	0.01	-0.70	0.70	0.15	Pass
128.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
130.00	0.01	-0.70	0.70	0.15	Pass
131.00	0.01	-0.70	0.70	0.15	Pass
132.00	0.01	-0.70	0.70	0.15	Pass
133.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
135.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.01	-0.70	0.70	0.15	Pass
139.00	0.01	-0.70	0.70	0.15	Pass
140.00	0.01	-0.70	0.70	0.15	Pass
141.00	0.01	-0.70	0.70	0.15	Pass
142.00	0.01	-0.70	0.70	0.15	Pass
143.00	0.01	-0.70	0.70	0.15	Pass
144.00	0.01	-0.70	0.70	0.15	Pass
145.00	0.01	-0.70	0.70	0.15	Pass
146.00	0.01	-0.70	0.70	0.15	Pass
147.00	0.01	-0.70	0.70	0.15	Pass
148.00	0.01	-0.70	0.70	0.15	Pass
149.00	0.01	-0.70	0.70	0.15	Pass
150.00	0.01	-0.70	0.70	0.15	Pass
-- End of measurement results--					

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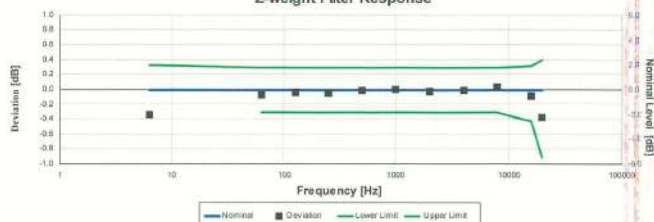
D0001.8407 Rev E

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Certificate Number 2021000734

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60804-2000 6.1 and 9.2.2, IEC 60804-2000 5, ANSI S1.4-1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.34	-0.34	-1.11	0.33	0.15	Pass
8.31	-0.07	-0.07	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass
-- End of measurement results--						

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Peak Rise Time

Peak rise time performed according to IEC 60851-2001 9.4.4 and ANSI S1.4-1983 (R2006) 8.4.4

Table 10: Test results according to EN 60321-2007 3.4.4 and Annex A1.4.1.150 (2006) 6.4.4							
Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.80	133.33	135.33	0.15	Pass
		Positive Pulse	134.80	133.32	135.32	0.15	Pass
	30	Negative Pulse	133.86	133.33	135.33	0.15	Pass
		Positive Pulse	133.86	133.32	135.32	0.15	Pass
-- End of measurement results--							

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.12	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
105.95	3	-0.12	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
-- End of measurement results--					

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
105.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
-- End of measurement results--					

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	40.26	39.40	40.80	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass
-- End of measurement results--					

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.88	36.00	Pass
C-weight Noise Floor	26.48	35.00	Pass
Z-weight Noise Floor	32.32	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.35	134.15	135.75	0.15	Pass
THD	-56.98	-58.00	-56.00	0.01 ±	Pass
THD+N	-52.82	-58.00	-56.00	0.01 ±	Pass

— End of measurement results—

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— End of Report—

Signature: *Ron Harris*

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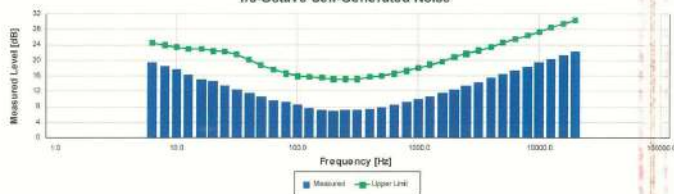
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1/3-Octave Self-Generated Noise



The SLIM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.52	24.60	Pass
8.00	18.49	24.00	Pass
10.00	17.75	23.50	Pass
12.50	16.32	23.00	Pass
16.00	15.18	22.90	Pass
20.00	14.71	22.40	Pass
25.00	13.51	22.30	Pass
31.50	12.54	21.50	Pass
40.00	11.63	20.20	Pass
50.00	10.78	18.80	Pass
63.00	9.83	17.60	Pass
80.00	9.18	16.60	Pass
100.00	8.49	15.90	Pass
125.00	7.73	15.70	Pass
160.00	7.20	15.50	Pass
200.00	7.05	15.20	Pass
250.00	7.13	15.20	Pass
315.00	7.15	15.20	Pass
400.00	7.49	15.70	Pass
500.00	7.97	16.00	Pass
630.00	8.48	16.60	Pass
800.00	9.24	17.30	Pass
1,000.00	10.02	18.10	Pass
1,250.00	10.78	18.90	Pass
1,600.00	11.71	19.80	Pass
2,000.00	12.58	20.80	Pass
2,500.00	13.53	21.70	Pass
3,150.00	14.46	22.60	Pass
4,000.00	15.47	23.50	Pass
5,000.00	16.42	24.50	Pass
6,300.00	17.41	25.50	Pass
8,000.00	18.36	26.50	Pass
10,000.00	19.39	27.40	Pass
12,500.00	20.38	28.50	Pass
16,000.00	21.35	29.50	Pass
20,000.00	22.35	30.40	Pass

— End of measurement results—

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List of Instrument/Equipment Certification for Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model / Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Laboratory Instrument/Equipments Water Quality Analysis.									
1	pH Meter	pH Temperature	Hanna Instrument	HI2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2102015-001-01	17 Mar 21	16 Mar 22	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 123052512	National Food Institute, Ministry of Industry, Thailand	2101930-001-01	17 Mar 21	16 Mar 22	-
3	pH Meter		Mettler-Toledo	1231155210	National Food Institute, Ministry of Industry, Thailand	2103272-001-02	1 Mar 22	28 Feb 23	-
4	Analytical Balance (Readability 0.01 mg)	Suspended Solids Total Dissolved Solids	Mettler-Toledo	XSR205DU / C009071872	Calibration Laboratory Mettler-Toledo (Thailand) Limited	2102573-001-01	26 Apr 21	25 Apr 22	-
5	Analytical Balance (Readability 0.01 mg)		Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
6	Hot Air Oven		Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	21TM813	21 Apr 21	20 Apr 22	-
7	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
8	Incubator	Total Coliform Bacteria Fecal Coliform Bacteria	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	21TM1874	28 Oct 21	27 Oct 22	-
9	Incubator		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	21TM706	21 Apr 21	20 Apr 22	-
10	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	21TM422	22 Feb 21	21 Feb 22	-
11	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	21TM423	23 Feb 21	22 Feb 22	-
12	Water Bath		Memmert	WB 14 / I401.0569	Technology Promotion Association (Thailand-Japan)	21TM1355/1	14 Jul 21	13 Jul 22	-

List of Instrument/Equipment Certification for Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model / Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
13	Water Bath	Total Coliform Bacteria Fecal Coliform Bacteria	Memmert	WNB 14 / L407.0756	Technology Promotion Association (Thailand-Japan)	21TM1356	14 Jul 21	13 Jul 22	-
14	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	2200705-001-01	24 Nov 21	23 Nov 22	-
15	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	National Food Institute, Ministry of Industry, Thailand	2200705-001-01	24 Nov 21	23 Nov 22	-
16	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	21TM425	23 Feb 21	22 Feb 22	-
17	Auto Clave		ALP	CL-40L / 807298	Technology Promotion Association (Thailand-Japan)	21TM831	7 May 21	6 May 22	-
18	Analytical Balance (Repeatability 0.1 mg)	Fat Oil & Grease	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2103270-001-01	11 Jun 21	10 Jun 22	-
19	Analytical Balance (Repeatability 0.1 mg)		Mettler-Toledo	AB-204-S 1128312528	Mettler-Toledo	TH2058-097-040722-	7 Apr 22	6 Apr 23	-
20	BOD Incubator	BOD	Arco	UR-1320 / (UAE.LAB.018/2551)	Technology Promotion Association (Thailand-Japan)	21TM811	21 Apr 21	20 Apr 22	-
21	BOD Incubator		Arco	UR-1320 / (UAE.LAB.006/2553)	Technology Promotion Association (Thailand-Japan)	21TM812	21 Apr 21	20 Apr 22	-
22	BOD Incubator		Arco	UC4-1320 / (UAELAB002/2550)	Technology Promotion Association (Thailand-Japan)	21TM1405	17 Aug 21	16 Aug 22	-
23	BOD Incubator		Arco	UC4-1320 / (UAELAB018/2559)	Technology Promotion Association (Thailand-Japan)	21TM1406	17 Aug 21	16 Aug 22	-

List of Instrument/Equipment Certification for Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model / Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
24	Digestor Unit	TKN	FOSS TECATOR	2520auto / 91794469	Thailand Institute Of Science And Technological Research (TISTR)	PSL-T 614/64	12 Mar 21	11 Mar 22	-
25	Digestor Unit		Velp	DKL20 / 213517	National Food Institute, Ministry of Industry, Thailand	2103014-001-02	7 Jun 21	6 Jun 22	-
26	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	Sithiporn Associates Co.,Ltd.	MS63FOT0084B	25 Feb 21	24 Feb 22	-

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

Calibration Certificate

Certificate No.: 2102015-001-01
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
 Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangkok, Prakanong, Bangkok 10260

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Equipment: pH Meter
 Manufacturer: HANNA INSTRUMENTS
 Model: HI 2211
 Serial No.: 08165345
 ID No.: UAE.WAT.004/2556
 Order No.: 2102015
 Operation No.: 2102015-001
 Date of Receipt: 16 March 2021
 Date of Calibration: 17 March 2021

Calibrated by Mr.Manas Somsak Expert
 Approved by (Mr.Pheraphat Tuanjit)
 Manager, Division of Calibration Laboratory
 Responsible for the Technical Management Team
 Date of Issue: 19 March 2021

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full, except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 2102015-001-01
 Equipment: pH Meter
 Resolution: 0.01 pH ; 0.1 mV
 Manufacturer: HANNA INSTRUMENTS
 Model: HI 2211
 Serial No.: 08165345
 Type: Bench top
 ID No.: UAE.WAT.004/2556

Date of Calibration: 17 March 2021 Page 3 of 5

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (± mV)	Coverage Factor (k)
		mV	pH		
0.00	414.118	414	0.00	0.58	2.00
2.00	295.811	295.7	2.00	0.063	2.00
4.00	177.461	177.5	4.00	0.063	2.00
6.00	59.160	59.2	6.00	0.063	2.00
7.00	0.000	0.1	7.00	0.063	2.00
8.00	-89.158	-89.1	8.00	0.063	2.00
10.00	-177.461	-177.3	10.00	0.063	2.00
12.00	-295.812	-295.6	12.00	0.063	2.00
14.00	-414.118	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode
 Manufacturer: HANNA INSTRUMENTS
 Model: HI 1131
 Serial No.: 05512F2N
 ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	165.0	95.8	0.0071	2.00
6.866	6.87	3.9		0.0075	2.00
9.866	9.87	3.9		0.0075	2.00
10.008	10.01	-172.7	94.5	0.0063	2.00
9.866	9.89	-4.0		0.0063	2.00

F-CS-012 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 2102015-001-01
 Equipment: pH Meter
 Resolution: 0.01 pH ; 0.1 mV
 Manufacturer: HANNA INSTRUMENTS
 Model: HI 2211
 Serial No.: 08165345
 Type: Bench top
 ID No.: UAE.WAT.004/2556

Date of Calibration: 17 March 2021 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
 Environment Condition: Ambient Temperature: (23.3 ± 1.5) °C Relative Humidity: (53.5 ± 5) %
 Condition of Equipment: Good Condition
 Condition of this Results of Calibration

1. Calibration Method In house method : W-CG-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	SCL-20P-0662	17 June 2021
2.2 Digital Thermometer	2709007	Fuke	OC 630608-01	30 October 2021
2.3 Thermo-Hygro Meter	NFLBTH-003/17	PONPE	QR20-1578	21 September 2021

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	710048	CPAchem	PH4216.L5	2 October 2022
2.5 pH buffer 6.865 (Primary pH buffer Solution)	710048	CPAchem	PH4217.L5	2 October 2022
2.6 pH buffer 10.01 (Primary pH buffer Solution)	710050	CPAchem	PH4220.L5	2 October 2021
2.7 pH buffer 7.00 (Standard pH buffer Solution)	710051	CPAchem	PH107.L5	2 October 2021

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1 through NSC-TIS-715 17025 Laboratory Accreditation of Calibration No.0075
 3.2 Instruments No.2.2 through NSC-TIS-715 17025 Laboratory Accreditation of Calibration No.0061
 3.3 Instruments No.2.3 through NSC-TIS-715 17025 Laboratory Accreditation of Calibration No.0292
 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Harned cell using calibrated thermocouple, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
 3.5 Certified Reference Material No. 2.7 traceable to BSM RefN Hi-7 Loth 30.04.2020; BSM RefN Hi-9 Loth 28.05.2020; BSM RefN Hi-8 Loth 30.04.2020; BSM RefN Hi-10 Loth 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2102015-001-01
 Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C
 Model: HI 2211
 Serial No.: 08165345
 ID No.: UAE.WAT.004/2556
 Manufacturer: HANNA INSTRUMENTS

Date of Calibration: 17 March 2021 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature 23 °C ± 1 °C
 Relative Humidity 54 % ± 2 %

Condition of this results of Calibration:

- Calibration Method :
 - In house method: W-TE-025 by comparison with standard thermometer.
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
 - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 767/83	04-Jun-21	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 3415922

3. This certificate is traceable to International System of Units (SI Units).

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item : Good
 7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2182015-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: HI 2211
Serial No.: 08165345 ID No.: UAE.WAT.004/2556
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 17 March 2021 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.

- Description of probe, model : - S/N : -

Dimension of probe : Diameter : 3.5 mm., Length : 100 mm.,

Sheath material : Stainless Steel

UUC* Reading	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
14.9	15.003	0.1	0.099
25.0	25.003	0.0	0.099
35.0	35.007	0.0	0.099

Note

- UUC* : Unit Under Calibration

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k=2$, providing a level of confidence of approximately 95 %.

-----End-----

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210 Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022 Page 2 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE

Environment Condition: Ambient Temperature: (23.5 ± 1.5) °C Relative Humidity: (53 ± 5) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method In house method : W-CO-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2706007	Fluke	SCL-21F-0687	24 June 2022
2.2 Digital Thermometer	2706007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	NFI.BTH100418	PONPE	GR22-0195	27 January 2023

Certified Reference Material	Lot No.	Manufacturer	Ref#	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	741339	CPAchem	PH216.L5	19 April 2023
2.5 pH buffer 6.865 (Primary pH buffer Solution)	741340	CPAchem	PH217.L5	19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	741342	CPAchem	PH220.L5	19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	735836	CPAchem	PH107.L5	16 March 2022

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NIS-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2	through	NIS-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NIS-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0282
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method: Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

3.5 Certified Reference Material No. 2.7 traceable to BSM Ref# HI-7 Luth 30.04.2020; BSM Ref# HI-9 Luth 28.05.2020; BSM Ref# HI-8 Luth 30.04.2020; BSM Ref# HI-10 Luth 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2201793-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1231155210

ID No.: UAE.WAT.010/2553

Order No.: 2201793

Operation No.: 2201793-001

Date of Receipt: 21 February 2022

Date of Calibration: 1 March 2022

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by
Specialist, Division of Calibration Laboratory

Date of Issue: 1 March 2022

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full, except with the prior written approval of the National Food Institute.

F-C5-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210 Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022 Page 3 of 5

Calibration Results:
1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0.00	414.117	414	0.00	0.58	2.00
2.00	295.811	296	2.00	0.58	2.00
4.00	177.462	178	4.00	0.58	2.00
6.00	59.159	59	6.00	0.58	2.00
7.00	-9.901	9	7.00	0.58	2.00
8.00	-59.159	-59	8.00	0.58	2.00
10.00	-177.463	-177	10.00	0.58	2.00
12.00	-295.812	-296	12.00	0.58	2.00
14.00	-414.119	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Serial No.: 1156852
Type: Combined Electrode
Model: InLabSolids
ID.No. N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.00	180	96.25	0.0076	2.00
6.866	6.88	16	-	0.0079	2.00
10.012	10.01	-162	96.13	0.0094	2.00
6.866	7.00	9	-	0.0097	2.00

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO

Date of Calibration: 1 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature 24 °C ± 1 °C
Relative Humidity 53 % ± 2 %

Condition of this results of Calibration:

1. Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2116154	PSL-T 085164	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	677332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item:

Good

7. Result of Calibration :

☒ X

Without adjustment

☐

After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2101930-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Sol Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1230525212
ID No.: UAE.WAS.0032553
Order No.: 2101930
Operation No.: 2101930-001
Date of Receipt: 10 March 2021
Date of Calibration: 17 March 2021

Calibrated by

Mr.Manas Somsak
Expert

Approved by

(Mr.Pharaphat Tuanjit)
Manager, Division of Calibration Laboratory

Responsible for the Technical Management Team

Date of Issue: 19 March 2021

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-005 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231155210 ID No.: UAE.WAT.0102553
Manufacturer: METTLER TOLEDO

Date of Calibration: 1 March 2022 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.

- Description of probe, model : N/A S/N : N/A

Dimension of probe : Diameter 4 mm, Length 100 mm

Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.006	-0.1	0.099
25.1	25.004	-0.1	0.099
35.1	35.003	-0.1	0.099

Note

- UUC* : Unit Under Calibration

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1230525212
Type: Bench top
ID No.: UAE.WAS.0032553

Date of Calibration: 17 March 2021 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature: (23.3 ± 1.5) °C Relative Humidity: (53.5 ± 5) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method : In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-30F-0682	17 June 2021
2.2 Digital Thermometer	2709007	Fluke	CG-630608-01	30 October 2021
2.3 Thermo-Hygro Meter	NFI.BTH-003/17	POHPE	QR20-1578	21 September 2021

Certified Reference Material

Lot No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	CPAchem	PH216.L5	2 October 2022
2.5 pH buffer 6.865 (Primary pH buffer Solution)	CPAchem	PH217.L5	2 October 2022
2.6 pH buffer 10.01 (Primary pH buffer Solution)	CPAchem	PH220.L5	2 October 2021
2.7 pH buffer 7.00 (Standard pH buffer Solution)	CPAchem	PH107.L5	2 October 2021

3. This certification is traceable to The International System of Unit (SI Unit)

- 3.1 Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0015
- 3.2 Instruments No.2.2 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
- 3.3 Instruments No.2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
- 3.4 Certified Reference Material No. 2.4 to 2.8 traceable to Primary measurement method: Hammett cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No. 2.7 traceable to BSM Ref H-7 Lot# 30.04.2020; BSM Ref H-10 Lot# 28.05.2020; BSM Ref H-8 Lot# 30.04.2020; BSM Ref H-10 Lot# 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
 Equipment: pH Meter
 Resolution: 0.01 pH ; 1 mV
 Manufacturer: METTLER TOLEDO Model: SevenEasy pH
 Serial No.: 1230525212 Type: Bench top
 ID No.: UAE.WAS.003/2553

Date of Calibration: 17 March 2021 Page 3 of 5

Calibration Results: 1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
		mV	pH		
9.00	414.118	414	9.00	0.58	2.00
7.00	295.511	296	7.00	0.58	2.00
4.00	177.461	178	4.00	0.58	2.00
6.00	59.160	59	6.00	0.58	2.00
7.00	0.000	0	7.00	0.58	2.00
8.00	-59.159	-59	8.00	0.58	2.00
10.00	-177.461	-177	10.00	0.58	2.00
12.00	-295.512	-296	12.00	0.58	2.00
14.00	-414.115	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode Type: Combined Electrode
 Manufacturer: METTLER TOLEDO Model: InLab Solids
 Serial No.: B453943 ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.005	4.01	195	97.5	0.0071	2.00
6.866	6.87	21		0.0075	2.00
6.866	6.87	21		0.0075	2.00
10.008	10.01	-161	98.0	0.0093	2.00
6.865	6.86	14		0.0093	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
 Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C Model: SevenEasy pH
 Serial No.: 1230525212 ID No.: UAE.WAS.003/2553
 Manufacturer: METTLER TOLEDO

Date of Calibration: 17 March 2021 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:
 - The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
 - Description of probe: model: SN:
 Dimension of probe: Diameter 3.5 mm, Length 120 mm.
 Sheath material: Stainless Steel

UUC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	15.003	-0.2	0.099
25.2	25.003	-0.2	0.099
35.2	35.007	-0.2	0.099

Note

- UUC: Unit Under Calibration

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k=2, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2101930-001-01
 Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C Model: SevenEasy pH
 Serial No.: 1230525212 ID No.: UAE.WAS.003/2553
 Manufacturer: METTLER TOLEDO

Date of Calibration: 17 March 2021 Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
 Environment Condition: Ambient Temperature 23 °C ± 1 °C
 Relative Humidity 54 % ± 2 %

Condition of this results of Calibration:

- Calibration Method:
 - In house method: W-TE-025 by comparison with standard thermometer.
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
 - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 767/83	04-Jun-21	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment: - Low Temperature Bath (SOCAL-6), Model: Europa-6 Plus Basic, S/N: 341992/2

3. This certificate is traceable to International System of Units (SI Units).

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item:

Good

7. Result of Calibration:

☒ Without adjustment

☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2102573-001-01
 Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
 Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2102573

Operation No.: 2102573-001

Date of Receipt: 26 April 2021

Date of Calibration: 26 April 2021

Calibrated by Mr.Manas Somsak
 Expert

Approved by (Mr.Pheraphat Tuanjit)
 Manager, Division of Calibration Laboratory

Date of Issue: 29 April 2021

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2102573-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Capacity: 81 g / 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 26 April 2021 **Page 2 of 4**

Environment Condition: Ambient Temperature: 23.2 ± 0.1 °C Relative Humidity: 48 ± 2 %

Place of Calibration: Balance Room (208), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method 01-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	838068554	TCS	PG21019975	12 January 2022
Standard Weight Class E2	1-500g	838068128	TCS	PG21019985	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	POMPE 490	NFI.8TH.004/18	Quality Reborn	QR21-6330	15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000048
80	0.0000032
100	0.0000006
200	0.0000006

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.00000	49.99999	50.00001	50.00001	49.99999	50.00000	0.00001

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2102573-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Capacity: 81 g / 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 26 April 2021 **Page 4 of 4**

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range >81 g to 200 g; Resolution 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor #
82	81.99988	82.00000	-0.00012	0.00012	2.00
85	84.99987	85.00000	-0.00013	0.00013	2.00
90	89.99988	90.00000	-0.00012	0.00013	2.00
95	94.99988	95.00000	-0.00012	0.00014	2.00
100	100.00000	100.00000	0.00000	0.00015	2.00
110	109.99996	110.00000	0.00004	0.00016	2.00
120	119.99999	120.00000	0.00001	0.00017	2.00
150	149.99990	150.00000	-0.00010	0.00020	2.00
170	169.99999	170.00000	-0.00001	0.00023	2.00
200	200.00009	200.00001	0.00008	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

----- End -----

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2102573-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Capacity: 81 g / 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 26 April 2021 **Page 3 of 4**

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range 0 - 81 g; Resolution 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor #
6.01	0.010002	0.010003	-0.000003	0.0000091	2.00
0.05	0.050004	0.050004	-0.000003	0.0000099	2.00
0.1	0.100006	0.100003	-0.000003	0.000011	2.00
0.2	0.200002	0.200004	-0.000004	0.000011	2.00
0.5	0.499999	0.500003	-0.000003	0.000014	2.00
1	1.000005	1.000001	0.000006	0.000014	2.00
2	2.000006	2.000001	-0.000001	0.000017	2.00
3	3.000011	3.000001	0.000006	0.000020	2.00
4	4.000014	4.000002	-0.000001	0.000023	2.00
5	5.000002	5.000002	-0.000002	0.000020	2.00
10	9.999980	10.000002	-0.000004	0.000029	2.00
20	19.999980	20.000004	-0.000005	0.000037	2.00
50	49.999903	49.999997	-0.000006	0.000083	2.00
70	69.999891	69.999955	-0.000006	0.00011	2.00
80	79.999871	79.999994	-0.000007	0.00015	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

F-C5-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2200708-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546

Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.Worapob Sooktong
Scientist

Approved by (Mr. Theraporn Tumpit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 30 November 2021

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-C5-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01

Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g

Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g/0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 Page 2 of 4

Environment Condition: Ambient Temperature: 22.0 ± 0.5 °C Relative Humidity: 39 ± 1 %

Place of Calibration: Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-M-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	asw.skl. BTH 003/55	Quality Rebam	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
15	0.000057
30	0.000064
50	0.000053
100	0.000048

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table:

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.0000	50.0000	49.9999	50.0000	49.9999	49.9999	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01

Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g

Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g/0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 31 - 100 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
40	40.00000	39.9999	0.0001	0.00014	2.00
45	44.99998	44.9999	0.0001	0.00015	2.00
50	49.99999	49.9999	0.0001	0.00016	2.00
55	54.99997	54.9998	0.0002	0.00016	2.00
60	60.00002	59.9999	0.0001	0.00018	2.00
65	65.00000	64.9999	0.0001	0.00018	2.00
70	70.00003	69.9999	0.0001	0.00019	2.00
75	75.00001	74.9999	0.0001	0.00020	2.00
80	80.00005	79.9998	0.0003	0.00021	2.00
85	85.00003	84.9998	0.0002	0.00022	2.00
90	89.99999	89.9998	0.0002	0.00021	2.00
100	99.99997	99.9998	0.0002	0.00020	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor of approximately 95 %.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01

Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g

Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g/0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-100 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 30 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
Unload	0.00000	0.0000	0.0000	0.000069	2.00
0.01	0.00998	0.0100	0.0000	0.00011	2.00
0.02	0.01997	0.0200	0.0000	0.00012	2.00
0.05	0.05001	0.0500	0.0000	0.00011	2.00
0.1	0.10002	0.1000	0.0000	0.00012	2.00
0.2	0.20004	0.2000	0.0000	0.00013	2.00
0.5	0.49994	0.5000	-0.0001	0.00014	2.00
1	0.99986	1.0000	-0.0001	0.00026	2.00
2	1.99984	1.9998	0.0001	0.00019	2.00
5	4.99979	4.9998	0.0000	0.00022	2.00
10	10.00026	9.9994	0.0009	0.00024	2.00
20	20.00037	19.9991	0.0013	0.00099	2.00
30	30.00063	30.0000	0.0006	0.00013	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
334-4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 21TM813
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven

Manufacturer: Memmert

Model: UF 55

Serial No.: B212.0411

ID No.: UAE.WAO.005/2556

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location: Lab Floor 2

Received Order: 21 April 2021

Calibration Date: 21 April 2021

Ambient Temperature: (26 ± 10) °C

Relative Humidity: (50 ± 30) %

Calibrated by: Khit Ruttanaprapachai

Approved by:

() Pomsippa Tameyakul

() Malee Butkruea

() Suwit Imjai

Issue Date: 5 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2104-0024OC-2
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 21TM813
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor
104.0	104.0	104.0	0.13	0.67	0.70	0.68	2
120.0	120.0	120.0	0.10	0.95	1.5	1.1	2
180.0	180.0	180.0	0.15	1.5	2.7	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.712	103.853	104.189	104.213	103.803	103.832	104.026	103.775	103.703
120.0	119.714	119.841	120.552	120.326	119.231	119.293	120.117	119.826	119.721
180.0	179.624	179.511	180.806	180.572	178.397	178.663	180.344	179.807	179.691

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM1876
 Page.: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
 Manufacturer : Memmert
 Model : UF 55
 Serial No. : B216.1666
 ID No. : UAE.WAO.027/2559
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangkok, Phrakhanong,
 Bangkok 10260
 Location : Lab Floor 2
 Received Order : 29 October 2021
 Calibration Date : 29 October 2021
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %

Calibrated by : Kunchit Prompratt

Approved by :
 Approved Signatory

(/) Ponthippa Tameyakul
 (/) Malee Butkruea
 () Suwit Imjai

Issue Date : 4 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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 Approval of the head of Corporate Services 3 : Equipment, Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2104-0024OC-2

Cert. No.: 21TM813
 Page.: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	20LM7	NIST, NIMT	18 May 2021

2. This certification is traceable to the SI unit.

3. This certificate is valid only to the item calibrated on date and place of calibration.

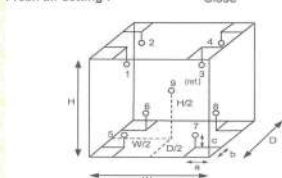
Remark : NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm
 D = 0.50 m
 W = 0.80 m
 H = 0.75 m
 Capacity = 0.30 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	29
REL.Humid. (%)	50	54
AC Supply (Volt)	221	222

Position :	Ref. Std./ID No.:
1	18-18TC-01
2	18-18TC-02
3	18-18TC-03
4	18-18TC-04
5	18-18TC-05
6	18-18TC-06
7	18-18TC-07
8	18-18TC-08
9 (ref.)	18-18TC-09

เอกสารไม่ควบคุม

a 1052723



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2110-0701OC-1

Cert. No.: 21TM1876
 Page.: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

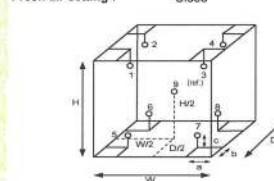
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm
 D = 0.33 m
 W = 0.40 m
 H = 0.40 m
 Capacity = 0.053 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	230	230

Ref. Std. ID No. : @ Calibration Point		
Position :	(140, 180) °C	(104) °C
1	21-15TC-01	15RTD2/11
2	21-15TC-02	15RTD2/12
3	21-15TC-03	15RTD2/13
4	21-15TC-04	15RTD2/14
5	21-15TC-05	15RTD2/15
6	21-15TC-06	15RTD2/20
7	21-15TC-07	15RTD2/17
8	21-15TC-08	15RTD2/18
9 (ref.)	21-15TC-09	15RTD2/19

เอกสารไม่ควบคุม



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2110-0701OC-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 21TM1876
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.11	0.52	0.72	0.42	2
140.0	140.0	140.0	0.25	1.1	1.4	1.1	2
180.0	180.0	180.0	0.16	0.87	1.2	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.852	103.978	104.382	104.323	103.776	104.015	104.312	104.196	103.907
140.0	140.309	140.730	140.426	140.270	139.531	139.666	140.067	139.895	139.750
180.0	180.598	180.339	180.755	180.619	179.716	179.829	180.204	180.365	179.975

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
 Note : The reported uncertainty of measurement was included stability and excluded uniformity .
 The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2110-0698OC-1
 Procedure Used :-

Cert. No.: 21TM1874
 Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

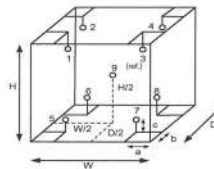
2. This certificate is valid only to the item calibrated on date and place of calibration.
 3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	22	22
REL.Humid. (%)	59	60
AC Supply (Volt)	226	226



Probe Installation Details :

Dimension of Chamber :

a = 5.0 cm	D = 0.50 m
b = 5.0 cm	W = 0.64 m
c = 5.0 cm	H = 0.80 m
	Capacity = 0.26 m ³

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/20
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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 TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM1874
 Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
 Manufacturer : Memmert
 Model : IPP 260
 Serial No. : V616.0066
 ID No. : UAE.MIC.032/2559
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory (302)
 Received Order : 28 October 2021
 Calibration Date : 28 - 29 October 2021
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Kunchit Promprat
 Approved by :
 Approved Signatory
 () Pornthippa Tameyakul
 (/) Malee Butkruea
 () Suwit Imjai
 Issue Date : 4 November 2021

The Uncertainties are for a confidence probability of approximately 95 %

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 Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2110-0698OC-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 21TM1874
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	25.0	24.5	0.053	0.25	0.42	0.30	2
35.0	35.0	35.0	0.029	0.43	0.75	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.007	24.986	24.943	24.894	24.653	24.806	24.672	24.694	24.786
35.0	35.340	35.384	35.336	35.307	34.680	35.120	34.813	34.996	35.088

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
 Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม



Cert. No.: 21TM706
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP260
Serial No. : V615.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 21 April 2021
Calibration Date : 21 April 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Kritsada Chaitrong

Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 5 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0027609



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2104-0019OC-1
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM706
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
35.0	35.0	35.0	0.11	0.36	0.55	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
Point (°C)	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	34.946	35.035	35.120	35.087	34.989	35.121	34.745	35.004	34.994

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1052707



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2104-0019OC-1
Procedure Used :-

Cert. No.: 21TM706
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44060450	21LM4	NIMT	06 Mar 2022

2. This certification is traceable to the SI unit.

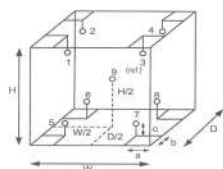
3. This certificate is valid only to the item calibrated on date and place of calibration.

Remark : NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.50 m
b = 10 cm	W = 0.64 m
c = 10 cm	H = 0.80 m
	Capacity = 0.26 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	23
REL.Humid. (%)	60	63
AC Supply (Volt)	223	224

Position :	Ref. Std. ID No.:
1	19-14RTD-01
2	19-14RTD-02
3	19-14RTD-03
4	19-14RTD-04
5	19-14RTD-05
6	19-14RTD-06
7	21-14RTD-07
8	19-14RTD-08
9 (ref.)	19-14RTD-09

เอกสารไม่ควบคุม

a 1052708



Cert. No.: 22TM563
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V615.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Prawit Sodavitchit

Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0040248



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2204-00160C-1
 Procedure Used :-

Cert. No.: 22TM563
 Page.: 2 of 3

Calibration was conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

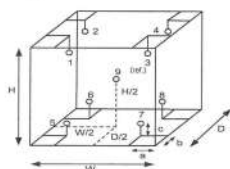
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL Humid. (%)	60	62
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19



Probe Installation Details :

Dimension of Chamber :
 a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm
 D = 0.50 m
 W = 0.64 m
 H = 0.80 m
 Capacity = 0.26 m³

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 22TM563

Equipment : Incubator

Model : IPP260

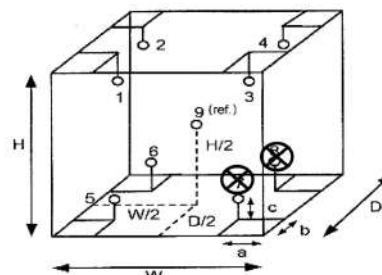
Serial No. : V615.0187

ID No. : UAE.MIC.003/2559

Manufacturer : Memmert

Calibration Point : 35 °C

Unit Under Calibration Setting : 35.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่.....7,8 (จุดเฝ้าระวัง).....

หมายเหตุ เก็บใบแนบ...../.....

Yuse metapp@metapp_LAB Lab-BK INSTRUMENT 11-2718 # Certificate กำหนดจุดห้ามใช้งานโดยมีป้ายห้ามใช้งานแนบมา
 Incubator_UAE.MIC.003_2559#21TM706.doc

เอกสารไม่ควบคุม

a 1104310

เอกสารไม่ควบคุม



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2204-00160C-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM563
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
35.0	35.0	35.0	0.12	0.53	0.79	0.30	2

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-o0o-

เอกสารไม่ควบคุม

a 1104309



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 21TM1355/1
 Page.: 1 of 3

Certificate of Calibration

This Certificate was issued to replace to the Certificate No. 21TM1355

Equipment : Water Bath

Manufacturer : Memmert

Model : WB 14

Serial No. : I401.0569

ID No. : UAE.MIC.004/2544

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260

Location : Microbiology Laboratory

Received Order : 14 July 2021

Calibration Date : 14 July 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Precha Hlaib

Approved by :

Approved Signatory

() Pornthippa Tameyakul

() Malee Butkruea

() Suwit Imjai

Issue Date : 30 July 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0030834



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2107-0318OC-5

Cert. No.: 21TM1355/1
 Page: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013823	21LM3	26 Feb 2022

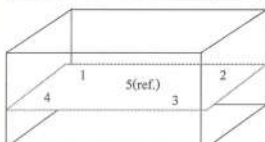
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	54	220
Finished of Calibration	25	57	222



Front

Position :	Ref. Std. S/N.:
1	4804539-006
2	4804539-007
3	4804539-008
4	4804539-009
5(ref.)	4804539-010

เอกสารไม่ควบคุม
 a 1065656



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 534/4 PATTANAKARN ROAD SOI 13, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM422
 Page: 1 of 3

Certificate of Calibration

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 14
 Serial No. : L416.0606
 ID No. : UAE.MIC.002/2560
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangkok, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory
 Received Order : 22 February 2021
 Calibration Date : 22 February 2021
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Man Pattanapongpaiboon
 Approved by :
 () Ponthippa Tameyakul
 () Malee Butkruea
 () Suwit Imjai
 Issue Date : 3 March 2021

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

A 0025137



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2107-0318OC-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM1355/1
 Page: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
41.5	41.2	41.2	41.418	41.379	41.374	41.447	41.420

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
41.5	0.084	0.043	0.15	2

Average* : The average of 30 values in each position.

Uniformity* : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability* : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม
 a 1065655



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2102-0751OC-3

Cert. No.: 21TM422
 Page: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44036292	20LM5	NIST, NIMT	10 Apr 2021

2. This certification is traceable to the SI unit.

3. This certificate is valid only to the item calibrated on date and place of calibration.

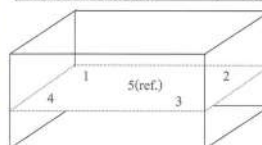
Remark : NIST : National Institute of Standards and Technology, The United States of America.

NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	24	54	219
Finished of Calibration	24	58	221



Front

Position :	Ref. Std. ID No.
1	70RC148
2	70RC149
3	70RC150
4	70RC151
5(ref.)	70RC152

เอกสารไม่ควบคุม

a 10A2921



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2102-0751OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM422
Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.462	44.465	44.510	44.496	44.460

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.097	0.046	0.15	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

๑ 1๐4๓๐๓



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2107-0318OC-6
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM1356
Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	45.0	45.0	44.480	44.502	44.490	44.486	44.483

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.072	0.053	0.15	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2171-3000-27 FAX: 0-2171-9444



Cert. No.: 21TM1356
Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB 14
Serial No. : L407.0756
ID No. : UAE.MIC.024/2550
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 14 July 2021
Calibration Date : 14 July 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib

Approved by :
Approved Signatory

() Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai

Issue Date : 20 July 2021

The Uncertainties are for a confidence probability of approximately 95 %

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Approval of the head of Corporate Services / Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2107-0318OC-6
Procedure Used :-

Cert. No.: 21TM1356
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013823	21LM3	26 Feb 2022

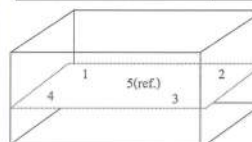
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	54	220
Finished of Calibration	25	57	222



Front

Position :	Ref. Std. S/N.:
1	4804539-006
2	4804539-007
3	4804539-008
4	4804539-009
5(ref.)	4804539-010

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SRI TH. SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM423
Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0612
ID No. : UAE.MIC.003/2560
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 22 February 2021
Calibration Date : 23 February 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Ponthippa Tameysakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 3 March 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม
0025138



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2102-0751OC-4
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM423
Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.531	44.474	44.492	44.514	44.537

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.12	0.044	0.15	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม
1043928



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2102-0751OC-4
Procedure Used :-

Cert. No.: 21TM423
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44036292	20LM5	NIST, NIMT	10 Apr 2021

2. This certification is traceable to the SI unit.

3. This certificate is valid only to the item calibrated on date and place of calibration.

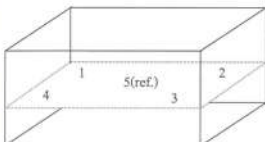
Remark : NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	
Beginning of Calibration	24	56	220
Finished of Calibration	24	59	221



Front

Position :	Ref. Std. ID No.
1	70RC148
2	70RC149
3	70RC150
4	70RC151
5(ref.)	70RC152

เอกสารไม่ควบคุม
1043929



National Food Institute, Ministry of Industry, Thailand

2009 Soi 36, Anur Amarin Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand
Tel : +66 (0) 2142 8558 Fax : +66 (0) 2142 8558 Website : www.nfi.or.th E-mail : cal@nfi.or.th



Calibration Certificate

Certificate No.: 2200705-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS603S/01
Serial No.: B007010311
ID No.: UAE.MIC.008/2553
Order No.: 2200705
Operation No.: 2200705-001
Date of Receipt: 24 November 2021
Date of Calibration: 24 November 2021

Calibrated by Mr.Jumpon Pimsri
Scientist
Approved by
(Mr.Praphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 30 November 2021

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-C5-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200705-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS603S/01
Resolution: 0.001 g
Serial No.: 8007010311
ID No.: UAE.MIC.008/2553
Capacity: 620 g

Date of Calibration: 24 November 2021 Page 2 of 3
Environment Condition: Ambient Temperature: 24.1 ± 0.6 °C Relative Humidity: 48 ± 2.5 %

Place of Calibration: 306 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	8306068554	TCS	M21019975	12 January 2022
Standard Weight Class E2	1-500g	8306068128	TCS	M21019985	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 450	NFL8TH 001/17	Quality Reborn	QR21-0299	15 February 2022

3. This certificate is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00052
600	0.00063

2. Off-Center Error:

A mass of 200 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
200.001	200.000	200.002	200.001	200.000	200.002	0.002

F-C5-012 Revision: 00 Date: 14-12-61

Calibration Report

Certificate No.: 2200705-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS603S/01
Resolution: 0.001 g
Serial No.: 8007010311
ID No.: UAE.MIC.008/2553
Capacity: 620 g

Date of Calibration: 24 November 2021 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.0000	0.000	0.000	0.00088	2.00
0.1	0.1000	0.099	0.001	0.00088	2.00
0.5	0.5000	0.500	0.000	0.00088	2.00
1	1.0000	1.000	0.000	0.00088	2.00
5	5.0000	5.000	0.000	0.00088	2.00
10	10.0000	10.000	0.000	0.00088	2.00
20	20.0000	20.000	0.000	0.00089	2.00
50	49.9999	50.001	-0.001	0.00089	2.00
70	69.9999	70.000	0.000	0.00089	2.00
100	100.0000	100.000	0.000	0.00090	2.00
150	149.9999	150.000	0.000	0.00091	2.00
200	200.0001	199.999	0.001	0.00093	2.00
300	300.0001	300.000	0.000	0.00097	2.00
400	400.0000	400.001	-0.001	0.0011	2.00
500	499.9999	500.001	-0.001	0.0012	2.00
600	599.9999	600.000	0.000	0.0013	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

----- End -----

F-C5-012 Revision: 00 Date: 14-12-61



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-37 FAX: 0-2719-9484



Cert. No.: 21TM831
Page: 1 of 3

Certificate of Calibration

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
301 Room
Received Order: 7 May 2021
Calibration Date: 7 May 2021
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Khit Rutanaprapachai
Approved by: 
() Ponthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date: 18 May 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Equipment: Autoclave
Condition As-Received: Used Item
Reference: 2105-00120C-1
Result of Calibration: () Without Adjustment

Cert. No.: 21TM831
Page: 3 of 3

Operating parameter Set: Temperature = 116 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
116	116	1	116.744	0.12	0.08	0.90	2
		2	116.549				
		3	116.515				

Operating parameter Set: Temperature = 122 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
122	122	1	122.672	0.078	0.12	1.1	2
		2	122.469				
		3	122.414				

Average* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2105-00120C-1

Cert. No.: 21TM831
Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	20LM7	18 May 2021

- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

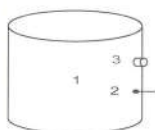
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



		Environmental		
		(°C)	(%R.H.)	(Volt)
Beginning of Calibration		24	62	222
Finished of Calibration		25	63	221

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	18-18TC-04
2 =	Temperature sensor	18-18TC-05
3 =	Exhaust port	18-18TC-06

เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2202-0444OC-1

Cert. No.: 22TM89
Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

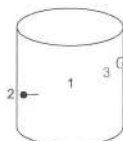
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



		Environmental		
		(°C)	(%R.H.)	(Volt)
Beginning of Calibration		27	68	226
Finished of Calibration		27	65	226

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-10TC-01
2 =	Temperature sensor	22-10TC-02
3 =	Exhaust port	22-10TC-03

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3090-27 FAX: 0-2719-9884



Cert. No.: 22TM89
Page.: 1 of 3

Certificate of Calibration

Equipment : Autoclave

Manufacturer : ALP

Model : CL-40L

Serial No. : 802664

ID No. : UAE.MIC.014/2550

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Air Analysis Unit

Received Order : 17 February 2022

Calibration Date : 17 February 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Kunchit Promprat

Approved by :

(/) Pornthippa Tameyakul
(/) Malee Butkrues
() Suwit Imjai

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

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Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2202-0444OC-1

Cert. No.: 22TM89
Page.: 3 of 3

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 122 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
122	122	1	122.373	0.32	0.12	1.2	2
		2	122.421				
		3	122.292				

Average* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9444



Cert. No.: 21TM425
Page: 1 of 3

Certificate of Calibration

Equipment : Autoclave
Manufacturer : ALP
Model : CL-40L
Serial No. : 802684
ID No. : UAE.MIC.014/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udumsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Air Analysis Unit
Received Order : 22 February 2021
Calibration Date : 23 February 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 3 March 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0025135



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2102-0751OC-1

Cert. No.: 21TM425
Page: 3 of 3

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 116 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
116	116	1	117.021	0.23	0.08	0.92	2
		2	117.111				
		3	117.212				

Operating parameter Set : Temperature = 122 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
122	122	1	122.817	0.15	0.12	1.10	2
		2	122.914				
		3	122.978				

Average* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1043934



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2102-0751OC-1
Procedure Used :-

Cert. No.: 21TM425
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	20LM6	NIST, NIMT	20 Apr 2021

2. This certification is traceable to the SI unit.

3. This certificate is valid only to the item calibrated on date and place of calibration.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
It does not cover autoclaves for use with material infected with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

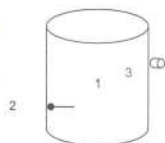
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Remark : NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	26	61	222
Finished of Calibration	26	63	223

Position	Description	Ref. Std. Thermocouple
1 =	Center of chamber	19-16TC-08
2 =	Temperature sensor	19-16TC-09
3 =	Exhaust port	19-16TC-10

เอกสารไม่ควบคุม

a 1043935



National Food Institute, Ministry of Industry, Thailand

4008 Soi 36, Arun Amart Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66 (0) 2422 6668 Fax : +66 (0) 2422 6045 Website : www.nfi.or.th E-mail : cal@nfi.or.th



Calibration Certificate

Certificate No.: 2103270-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udumsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: Mettler Toledo
Model: AB204-S/FACT
Serial No.: 1129361010
ID No.: UAE.WAS.002/2552
Order No.: 2103270
Operation No.: 2103270-001
Date of Receipt: 11 June 2021
Date of Calibration: 11 June 2021

Calibrated by Mr.Yothin Charoensuk
Scientist
Approved by
(Mr.Phiphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 15 June 2021

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full, except with the prior written approval of the National Food Institute.

F-C5-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103270-001-01

Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g

Manufacturer: Mettler Toledo
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 11 June 2021

Page 2 of 3

Environment Condition: Ambient Temperature: 21.1 ± 0.4 °C Relative Humidity: 48 ± 4 %

Place of Calibration: Laboratory, united analyst and engineering consultant co.,ld.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M20040405	20 April 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 400	NFL8TH 004/18	Quality Reborn	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000067
200	0.000057

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.0000	49.9999	49.9999	50.0000	50.0000	50.0000	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate ID
TH2058-097-040722-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lassafer Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0362
MT-TH-ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong Contact: Suvit Chotnuk
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 4033423924

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: AB204-S Asset Number: UAE.AIR.019/2550
Serial No.: 1128312528 Terminal Model: N/A
Building: N/A Terminal Serial No.: N/A
Floor: 2 Terminal Asset No.: N/A
Room: Balance Room 2 (206)

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 22.5 °C End: 21.4 °C	Start: 56.1 % End: 63.2 %

As Found Calibration Date: 07-Apr-2022

As Left Calibration Date: N/A

Issue Date: 08-Apr-2022

Calibrator:

Approved Signatory:

☒ Kassakorn Tassanasachakul
☐ Santi Jitniyom
☐ Surachet Sukkale

Software Version: 1.23.0.258

Report Version: 3.16.13

Form Number: F103C

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Page 1 of 5

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2103270-001-01

Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g

Manufacturer: Mettler Toledo
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 11 June 2021

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
Unload	0.00000	0.0000	0.0000	0.000092	2.00
0.01	0.01000	0.0100	0.0000	0.000092	2.00
0.05	0.05000	0.0500	0.0000	0.000092	2.00
0.1	0.10001	0.1000	0.0000	0.000093	2.00
0.2	0.20001	0.2001	-0.0001	0.000093	2.00
0.5	0.50001	0.5000	0.0000	0.000093	2.00
1	1.00001	1.0000	0.0000	0.000093	2.00
2	2.00002	2.0001	-0.0001	0.000093	2.00
5	5.00002	4.9999	0.0001	0.000094	2.00
10	10.00001	9.9999	0.0001	0.000096	2.00
20	20.00003	20.0000	0.0000	0.00010	2.00
50	50.00004	50.0000	0.0000	0.00012	2.00
70	70.00007	70.0000	0.0001	0.00014	2.00
100	100.00009	100.0000	0.0001	0.00016	2.00
150	150.00013	150.0000	0.0001	0.00021	2.00
200	200.00016	200.0001	0.0001	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

----- End -----

เอกสารไม่ควบคุม

F-CS-012 Revision: 00 Date: 14-12-61

Calibration Certificate ID
TH2058-097-040722-ACC-TH

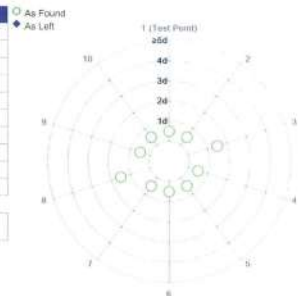
METTLER TOLEDO Service

Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A
Standard Deviation	0.00008 g	N/A



The "s" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A
Maximum Deviation	0.0002 g	N/A



As Found
The "s" in the graph represents the readability of the range/interval in which the test was performed.

Software Version: 1.23.0.258

Report Version: 3.16.13

Form Number: F103C

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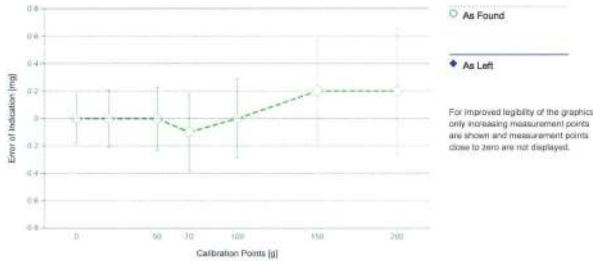
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Page 2 of 5

เอกสารไม่ควบคุม

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg	2
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg	2
8	70.0001 g	70.0000 g	-0.0001 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.40 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.46 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.: WS80 Date of Issue: 23-Feb-2022
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

Equipment No.: IN181 Date of Issue: 14-Jun-2021
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-4} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use: $3 K$

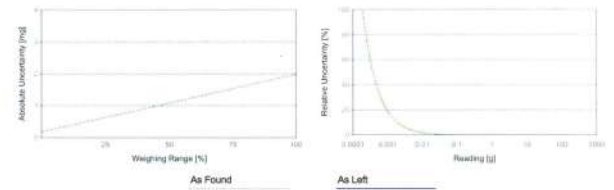
Linearization of Uncertainty Equation

Range	Max	As Found	As Left
1 0.0001 g	220 g	$U_L = 0.19 \text{ mg} + 0.00617 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.0220 g	0.19 mg	0.86%
0.2200 g	0.19 mg	0.087%
2.2000 g	0.21 mg	0.0095%
22.0000 g	0.37 mg	0.0017%
220.0000 g	2.0 mg	0.00090%



Remarks

Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory
Test weight by Filter pan: 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-4484



Cert. No.: 21TM811
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.018/2551
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 21 April 2021
Calibration Date : 21 April 2021
Ambient Temperature : $(26 \pm 10) ^\circ C$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Khit Rutanaprapachai
Approved by :

Issue Date : 5 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2104-0024OC-3
 Procedure Used :-

Cert. No.: 21TM811
 Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	20LM7	NIST, NIMT	18 May 2021

2. This certification is traceable to the SI unit.

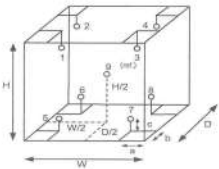
3. This certificate is valid only to the item calibrated on date and place of calibration.

Remark : NIST : National Institute of Standards and Technology, The United State of America.
 NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m ³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	47	51
AC Supply (Volt)	221	222

Position :	Ref. Std./ID No.:
1	18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

เอกสารไม่ควบคุม

a 1052721



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 33/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10258
 TEL. 0-2717-3086-27 FAX. 0-2719-9484



Cert. No.: 21TM1405
 Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : -

ID No. : UAE.WAQ.002/2550

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260

Location : Lab Floor 2

Received Order : 17 August 2021

Calibration Date : 17 August 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Khil Rutnanaprapachai

Approved by :

Approved Signatory

() Pornthippa Tameyakul

(/) Malee Butkruea

() Suwit Imjai

Issue Date : 1 September 2021

The Uncertainties are for a confidence probability of approximately 95%

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 Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0031567



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2104-0024OC-3
 Result of Calibration :- (*) Without Adjustment

Cert. No.: 21TM811
 Page.: 3 of 3

Function of UUC* : Temperature Source

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	20.0	0.15	0.47	0.86	0.31	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.368	20.509	20.115	20.023	19.826	19.955	20.135	20.269	20.101

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1052720



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2108-0364OC-1
 Procedure Used :-

Cert. No.: 21TM1405
 Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	21LM2	18 Feb 2022

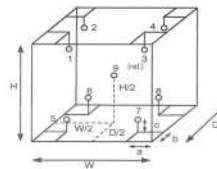
2. This certification is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.53 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.78 m ³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	29
REL.Humid. (%)	52	55
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

เอกสารไม่ควบคุม

a 1069646



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2108-0364OC-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 21TM1405
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	19.5	19.3	0.46	0.45	1.0	0.78	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.018	20.137	20.086	19.942	20.157	20.093	19.968	19.860	20.048

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
 Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
 UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1069645



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2108-0364OC-2
 Procedure Used :-

Cert. No.: 21TM1406
 Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	21LM2	18 Feb 2022

2. This certificate is valid only to the item calibrated on date and place of calibration.

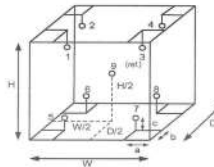
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	29
REL.Humid. (%)	52	55
AC Supply (Volt)	220	221



Probe Installation Details :

a = 10 cm
 b = 10 cm
 c = 10 cm

Dimension of Chamber :

D = 0.53 m
 W = 1.2 m
 H = 1.2 m
 Capacity = 0.76 m³

Position :	Ref. Std. ID No.:
1	21-04RTD-11
2	21-04RTD-12
3	21-04RTD-13
4	21-04RTD-14
5	21-04RTD-15
6	21-04RTD-16
7	21-04RTD-17
8	21-04RTD-18
9 (ref.)	21-04RTD-19

เอกสารไม่ควบคุม

a 1069644



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 55/4 PATTANAKARN ROAD SOI 11, SUANLIANG, SUANLIANG BANGKOK 10250
 TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 21TM1406
 Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : -

ID No. : UAE.WAO.018/2559

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260

Location : Lab Floor 2

Received Order : 17 August 2021

Calibration Date : 17 August 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Khit Ruttanaprapachal

Approved by :
 Approved Signatory

() Porphippa Tameyaskul
 (✓) Malee Butkrues
 () Suwit Imjai

Issue Date : 1 September 2021

The Uncertainties are for a confidence probability of approximately 95%

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 Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0031568



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2108-0364OC-2
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 21TM1406
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	19.8	19.7	0.37	0.50	1.1	0.62	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.040	19.742	20.203	19.762	19.784	19.819	19.764	19.797	19.787

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1069644



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 21TM812
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.006/2553
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 21 April 2021
Calibration Date : 21 April 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Khit Ruttanapachai
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai
Issue Date : 5 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0027601



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2104-0024OC-4
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 21TM812
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	19.8	0.37	0.39	1.0	0.58	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.059	20.108	19.849	19.766	20.117	20.291	19.725	19.756	20.008

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1052718



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2104-0024OC-4
Procedure Used :-
Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Cert. No.: 21TM812
Page.: 2 of 3

Condition of this result of calibration

1. Reference standard instrument-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	20LM7	NIST, NIMT	18 May 2021

2. This certification is traceable to the SI unit.

3. This certificate is valid only to the item calibrated on date and place of calibration.

Remark : NIST : National Institute of Standards and Technology, The United State of America.
NIMT : National Institute of Metrology Thailand.

Result of Calibration :- (*) Without Adjustment

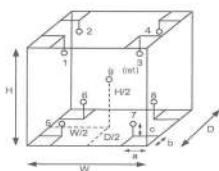
Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	47	51
AC Supply (Volt)	221	222

Position :	Ref. Std./ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	18-18RTD-06
7	18-18RTD-07
8	18-18RTD-08
9 (ref.)	18-18RTD-09

Probe Installation Details : Dimension of Chamber :
a = 10 cm D = 0.62 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.89 m³



เอกสารไม่ควบคุม

a 1052719

National Food Institute, Ministry of Industry, Thailand

2008 Soi 26, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66 (0) 2422 8588 Fax : +66 (0) 2422 8545 Website : www.nfi.go.th E-mail : cal@nfi.go.th



Verification Certificate

Substitute for Certificate No.: 2103014-001-01
Certificate No.: 2103014-001-02
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PRAKHANONG, BANGKOK, 10260

Page 1 of 4

Equipment: HEATING BLOCK DIGESTION
Manufacturer: VELP SCIENTIFICA
Model: DKL20
Serial No.: 213517
ID No.: UAE.WAS.005/2555
Order No.: 2103014
Operation No.: 2103014-001
Date of Receipt: 30 May 2021
Date of Calibration: 2,7 June 2021

Calibrated by Mr.Nuttapol Niyomchat Expert
Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 25 June 2021

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-C5-011 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



Verification Report

Certificate No.: 2103014-001-02
Equipment: HEATING BLOCK DIGESTION
Model: DKL20 Serial No.: 213517
Resolution: 1 °C ID No.: UAE.WAS.005/2555
Manufacturer: VLP SCIENTIFICA
Date of Calibration: 2,7 June 2021 Page 2 of 4

Location: Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition:
Ambient Temperature (25 ± 3) °C
Relative Humidity (55 ± 15) %
Line Voltage (220 ± 10) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
- The temperature scale used was based on ITS - 90 .
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34570A/34901A	MY44045576/MY421194453	TC21/0041	24-Apr-2022	N.M. Technical Center Laboratory
Type R	TCR101-103 / CH4101-103				

3. This certificate is traceable to international system of units (SI Units).

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item : Good

UUC* Description
Time of Record ~ Hour 30 Minute At 380 °C

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

เอกสารไม่ควบคุม



Verification Report

Certificate No.: 2103014-001-02
Equipment: HEATING BLOCK DIGESTION
Model: DKL20 Serial No.: 213517
Resolution: 1 °C ID No.: UAE.WAS.005/2555
Manufacturer: VLP SCIENTIFICA
Date of Calibration: 2,7 June 2021 Page 4 of 4

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Remark: Edited ID No. from UAE.WAS.005/2555 to UAE.WAS.005/2555.

Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor providing a level of confidence of approximately 95 %.

เอกสารไม่ควบคุม



Verification Report

Certificate No.: 2103014-001-02
Equipment: HEATING BLOCK DIGESTION
Model: DKL20 Serial No.: 213517
Resolution: 1 °C ID No.: UAE.WAS.005/2555
Manufacturer: VLP SCIENTIFICA
Date of Calibration: 2,7 June 2021 Page 3 of 4

Calibration point: 380 °C

Calibration result:

Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (± °C)	Standard Thermometer (°C)	Uncertainty (± °C)
1	380	379 - 380	0.53	383.17	1.8
2	380	379 - 380	0.32	383.16	1.8
3	380	379 - 380	0.39	382.96	1.8
4	380	379 - 380	0.18	381.23	1.8
5	380	379 - 380	0.49	382.97	1.8
6	380	379 - 380	0.49	382.85	1.8
7	380	379 - 380	0.54	382.97	1.8
8	380	379 - 380	0.24	382.95	1.8
9	380	379 - 380	0.61	383.17	1.8
10	380	379 - 380	0.73	381.14	1.9
11	380	379 - 380	0.73	382.53	1.9
12	380	379 - 380	0.76	381.56	1.9
13	380	379 - 380	0.38	382.25	1.7
14	380	379 - 380	0.43	383.00	1.7
15	380	379 - 380	0.31	383.08	1.7
16	380	379 - 380	0.22	381.78	1.7
17	380	379 - 380	0.31	382.99	1.7
18	380	379 - 380	0.37	383.24	1.7
19	380	379 - 380	0.32	380.98	1.7
20	380	379 - 380	0.31	382.63	1.7

Notes:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

เอกสารไม่ควบคุม



Verification Certificate

Certificate No.: 2202361-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Equipment: HEATING BLOCK DIGESTION

Manufacturer: FOSS

Model: 2520

Serial No.: 91794469

ID No.: UAE.WAS.011/2560

Order No.: 2202361

Operation No.: 2202361-001

Date of Receipt: 4 April 2022

Date of Calibration: 4-6 April 2022

Calibrated by Mr.Nuttapong Niyomchat
Specialist

Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 11 April 2022

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

เอกสารไม่ควบคุม

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 Serial No.: 91794469
Resolution: 1 °C ID No.: UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 4-6 April 2022

Page 2 of 4

Location: Laboratory Room, NATIONAL FOOD INSTITUTE
Environment Condition:
Ambient Temperature (25 ± 3) °C
Relative Humidity (55 ± 15) %
Line Voltage (220 ± 10) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
- The temperature scale used was based on ITS - 90 .
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A/34901A	MY49045578 / MY41194453	TC21/0041	24-Apr-2022	N.M. Technical Center Laboratory
	Type R	TCF101-103 / CHF101-103			

- This certificate is traceable to international system of units (SI Units).

- This certificate was certified only for the instrument we calibrated.

- This result of calibration was found accurate as shown on date and place of calibration only.

- Condition of Calibrated item : Good

UUC* Description

Time of Record - Hour 30 Minute At 380 °C

- Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 00 Date: 14-12-61

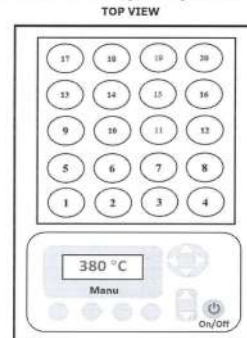
เอกสารไม่ควบคุม

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 Serial No.: 91794469
Resolution: 1 °C ID No.: UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 4-6 April 2022
Calibration point: 380 °C
Calibration result: Continued

Page 4 of 4

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Sensor Installation Location

Note:

- UUC* = Unit Under Calibration

- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.

- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k=2$, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 Serial No.: 91794469
Resolution: 1 °C ID No.: UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 4-6 April 2022

Page 3 of 4

Calibration point: 380 °C

Calibration result:

Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.13	376.48	1.5
2	380	380	0.12	376.58	1.5
3	380	380	0.12	376.51	1.5
4	380	380	0.14	376.70	1.6
5	380	380	0.18	376.81	1.6
6	380	380	0.12	377.23	1.6
7	380	380	0.12	377.37	1.5
8	380	380	0.13	376.68	1.5
9	380	380	0.14	376.72	1.5
10	380	380	0.18	378.97	1.6
11	380	380	0.25	378.79	1.6
12	380	380	0.11	377.14	1.6
13	380	380	0.19	379.65	1.6
14	380	380	0.16	379.61	1.6
15	380	380	0.16	378.66	1.6
16	380	380	0.15	379.18	1.6
17	380	380	0.23	377.39	1.6
18	380	380	0.11	377.71	1.6
19	380	380	0.22	376.64	1.6
20	380	380	0.16	376.56	1.6

Note:

- UUC* = Unit Under Calibration

- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.

- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม



TISTR

Request No.: 22-64/0445

MTC No.: PSL-T 614/64

TEST REPORT

Nomenclature : HEATING BLOCK DIGESTION

Serial No.: 91794469

Maker : FOSS

Model : 2520

Id.No.: UAE.LAB.011/2560

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address : 3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260.

Date of request : 12 March 2021

Date of test : 12 March 2021

Place of test : Photometry and Temperature Standards Laboratory, MTC, Bangpoo.

Point of test : Calibrated at 380 °C.

Conditions of test : - Ambient temperature: (25 ± 5) °C, Relative humidity : (50 ± 20) %.

- AC Power supply : (220 ± 5) % VAC.

Reference Standard : Data Acquisition / Switch Unit Equipped, Model : 34972A, S/N : MY49004645,

Maker : Agilent with Sensor TC-S, S/N : TC-S 01 ~ 02, through Calibration

certificate No.: 22-63/0516, PSL-T 678/63, Date of Calibrated 20 April 2020

Traceability : This certificate is traceable to SI unit through Photometry and Temperature Standards

Laboratory, Industrial Metrology and Testing Service Centre, Thailand Institute of Scientific

and Technological Research (TISTR), NSC-ONSC accredited no. Calibration 0015.

Test Procedure : Indicate temperature of Unit Under Test (UUT) was compared to temperature

Obtained from reference standards at calibration point.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990 (ITS-90).

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95 %.

page 1 of 4

The results relate only to the items tested or calibrated.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office

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E-mail : jurnal@tistr.or.th

เอกสารไม่ควบคุม

FM.BIL.MTC.002 Rev.3

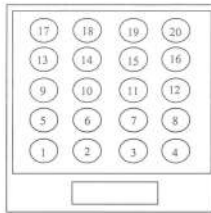


Request No.: 22-64/0445

MTC No.: PSL-T 614/64

Serial No.: 91794469

Results :



Top View

Tested at 380 °C	Temperature of UUT at each position (°C)				
UUT Setting 380 °C	1	2	3	4	5
Maximum	378.5	377.7	378.5	377.8	379.2
Minimum	378.2	377.4	378.2	377.5	378.9
Mid-Range	378.3	377.6	378.3	377.6	379.0
Difference	0.3	0.3	0.3	0.3	0.3
Uncertainty of measurement (± °C)	1.5	1.5	1.5	1.5	1.5

Note : - Reference Standards are measurement in tube sand at 240 value record after temperature stability.
- Level high of sand is equal heater plate of UUT.

page 2 of 4

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FM.BIL.MTC.002 Rev.3



Request No.: 22-64/0445

MTC No.: PSL-T 614/64

Serial No.: 91794469

Results :

Tested at 380 °C	Temperature of UUT at each position (°C)				
UUT Setting 380 °C	6	7	8	9	10
Maximum	377.6	379.8	378.1	379.5	377.7
Minimum	377.4	379.4	377.9	379.3	377.6
Mid-Range	377.5	379.6	378.0	379.4	377.6
Difference	0.2	0.5	0.2	0.2	0.2
Uncertainty of measurement (± °C)	1.5	1.5	1.5	1.5	1.5

Tested at 380 °C	Temperature of UUT at each position (°C)				
UUT Setting 380 °C	11	12	13	14	15
Maximum	379.1	377.5	378.0	377.9	377.7
Minimum	378.8	377.2	377.6	377.7	377.4
Mid-Range	379.0	377.4	377.8	377.8	377.5
Difference	0.2	0.4	0.3	0.2	0.3
Uncertainty of measurement (± °C)	1.5	1.5	1.5	1.5	1.5

Note : - Reference Standards are measurement in tube sand at 240 value record after temperature stability.
- Level high of sand is equal heater plate of UUT.

page 3 of 4

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FM.BIL.MTC.002 Rev.3



Request No.: 22-64/0445

MTC No.: PSL-T 614/64

Serial No.: 91794469

Results :

Tested at 380 °C	Temperature of UUT at each position (°C)				
UUT Setting 380 °C	16	17	18	19	20
Maximum	376.9	379.4	378.7	379.7	378.3
Minimum	376.6	379.1	378.4	379.5	378.1
Mid-Range	376.7	379.2	378.5	379.6	378.2
Difference	0.3	0.3	0.3	0.2	0.2
Uncertainty of measurement (± °C)	1.5	1.5	1.5	1.5	1.5

Note : - Reference Standards are measurement in tube sand at 240 value record after temperature stability.
- Level high of sand is equal heater plate of UUT.

Tested by :

(Mr. Phatthampong Chanthamart)

Approved by :

(Mr. Kamoln Singhapitak)

Director

Photometry and Temperature Standards Laboratory

Ref. : 2012264031201170001

Issued date : 16 March 2021

page 4 of 4

The results relate only to the items tested or calibrated.

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FM.BIL.MTC.002 Rev.3

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E-mail : sumalee@tistr.or.th

FOSS

Customer Service Report

Date:	30/11/21	Report No:	5874
Customer:	UAG	Address:	91 ซ.พหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10110
Instrument:	KT200	Serial:	91890529
Hours	Travel To Customer	Labour	Travel From Customer
Start	8:00	7:00	16:00
Finish	16:00	15:00	15:00

Job Type			
Application	Special	Standard	
Normal	Courtesy Visit	Installation	Training
Distributor	PMA Onboarding	Quote	In House
Internal	Warranty	Repair	PM
Digital Service	Sales Support	Remote	Other

PO/Quote Number: 123456789

PMA Type: Foss care-Pro Contract No. 123456789

Details of Work / Test	Condition / Status
- Check Instrument	OK
- replace PM kit for KT200	Pass
- replace Safety Valve	Pass
- replace Rubber Argonment	Pass
- replace Seal	Pass
- replace Heating element	Pass
- replace New panel PCB	Pass
- replace Safety det	Pass
- Clean & Lubricant	Pass
- Check Leaked	Pass
- Check Volum	Pass

Instrument Ready for Use ☒ OK ☐ Not OK

Part No.	Batch	Description	Qty
1000000005	11235-003	Foss PM kit for KT200	1
1575000000	75.00.0.01	Safety Valve	1
1575000000	09.11.30	Rubber Argonment for Heating	2
1100000000	02.00.01	Heating Element	1
1000000000	11.11.00	Seal	1
1000000000	16.00.00	KT200 new panel PCB	1
1000000000	22.00.01	Safety det complete	1

Signed FOSS

Name

Would you be willing to participate in a brief survey in order to tell us how we performed?

เอกสารไม่ควบคุม

FOSS Preventive Maintenance Protocol

FossCare™

Customer : UAE

Instrument	Kjeltec™ 2100 - Kjeltec 200	
Recommended PM interval (whichever occurs first between interval and no. of samples analysed)	12 months	No. of samples analysed (if applicable):
Preventive maintenance kit (P/N)	10009965	S/N 91790524

Introduction

A maintenance protocol provides systematic and functional means of maintaining a specific instrument type. The recommended PM interval depends on the operational conditions and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be considered. A demanding environment, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

NOTE:

The content of this protocol is subject to change over time. In order to safeguard that you obtain the correct parts, please make sure to indicate serial no and date of installation when contacting your FOSS representative.

Dedicated Analytical Solutions

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DK-3400 Hillerød
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Fax +45 7010 3371
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Web www.foss.dk

FOSS Analytical AB
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Tel +46 42 381500
Fax +46 42 340349
E-mail support@foss.dk
Web www.foss.dk

Customer Support, 1001 4572 / Rev. 3

1(2)

เอกสารไม่ควบคุม

SITHIPHORN
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Preventive Maintenance Protocol

Instrument: Kjeltec™ 2100	Model KJ200	S/N: 91790524
Customer บริษัท อูโนสท์ แอวอน จำกัด แอวอน เคมิคอลส์ จำกัด	Job No.	MS63POT0848
Certified performed PM interval (whichever occurs first between interval and no. of samples analysed)	12 Months	No. of samples analysed (if applicable):

Introduction

A maintenance protocol provides a systematic and functional means of maintaining a specific instrument type, the certified performed PM interval depends on the operational conditions, and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be taken into account. Demanding environments, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

The content of this protocol is subject to change over time. In order to ensure you the correct parts, please make sure to indicate serial number and date of installation when contacting you FOSS representative.

Maintenance Procedure

Parts to be Exchanged

Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	10000056	<input type="checkbox"/>
2	Replace	Non return valve	10003538	<input type="checkbox"/>
3	Replace valves in alkali pump	Valve kit reagent/water pump	15750093	<input type="checkbox"/>
4	Replace steam tubing	Silicone tubing 8/12 mm	15820006	<input type="checkbox"/>
5	Replace alkali tubing	Tubing reinforced for alkali	15820011	<input type="checkbox"/>
6	Replace water tubing	Tubing PVC 8/11 mm	15820004	<input type="checkbox"/>
7	Cleaning	Steam generator		<input type="checkbox"/>
8	Cleaning	Splash head		<input type="checkbox"/>

451-451/1 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-24358800, 0-2434-9191 แฟกซ์ 0-2433-1679, 0-2434-9510
451-451/1 Srinthorn Road, Bangbunru, Bangkok 10700, Thailand Tel.(662) 433-8331, 435-8800, 434-9191 FAX 433-1679, 434-9510
EMAIL: center@sithiphorn.com www.sithiphorn.com เอกสารไม่ควบคุม

Maintenance Procedure

Exchange of Parts and Cleaning

Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	1000 0056	<input type="checkbox"/>
2	Replace	Non return valve	1000 3538	<input type="checkbox"/>
3	Replace valves in alkali pump	Valve kit reagent/water pump	1575 0093	<input type="checkbox"/>
4	Replace steam tubing	Silicone tubing 8/12 mm	1582 0006	<input type="checkbox"/>
5	Replace alkali tubing	Tubing reinforced for alkali	1582 0011	<input type="checkbox"/>
6	Replace water tubing	Tubing PVC 8/11 mm	1582 0004	<input type="checkbox"/>
7	Cleaning	Steam generator		<input type="checkbox"/>
8	Cleaning	Splash head		<input type="checkbox"/>

Check and Adjustments

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	๙.๘	At 50 ml -0/+3 ml	<input checked="" type="checkbox"/>
2	Check distillation volume		120 ml	100 - 150 ml/4 min	<input checked="" type="checkbox"/>
3	Check front panel switches				<input checked="" type="checkbox"/>
4	Check cables and electrical connections				<input checked="" type="checkbox"/>
5	Check level pins in steam generator				<input checked="" type="checkbox"/>
6	Check safety door switch				<input checked="" type="checkbox"/>

SITHIPHORN
associates

Check and Adjustment

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	๙.๘ ml	At 50 ml -0/+3 ml	<input checked="" type="checkbox"/>
2	Check distillation volume		120 ml	100 - 150 ml/4min	<input checked="" type="checkbox"/>
3	Check front panel switches				<input checked="" type="checkbox"/>
4	Check cable,electrical connection and main power supply AC 220 Volts				<input checked="" type="checkbox"/>
5	Check level pins in steam generator				<input checked="" type="checkbox"/>
6	Check safety door switch				<input checked="" type="checkbox"/>

Remark _____

Signature of S. Singhaporn Signature of S. Singhaporn

Date ๑๕/๐๑/๒๕๖๑

Customer Support, 1001 4572 / Rev. 3

2(2)

เอกสารไม่ควบคุม

451-451/1 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10700 โทร. 0-2433-8331, 0-24358800, 0-2434-9191 แฟกซ์ 0-2433-1679, 0-2434-9510
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EMAIL: center@sithiphorn.com www.sithiphorn.com เอกสารไม่ควบคุม

ภาคผนวก จ

หนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์



ที่ อก ๐๓๑๐(๑)/ ๑๘๗๕

กรมโรงงานอุตสาหกรรม
กรมพระรามที่ ๖ นางรพีพร ฤทธิ
กระทรวงฯ กรุงเทพฯ ๑๐๕๐๐

๐ ๙ กุมภาพันธ์ ๒๕๖๕

เรื่อง คออาชญากรรมขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน และขอติดสติกเกอร์ห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๗ ธันวาคม ๒๕๖๔

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย
๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย
๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่อ้างถึง บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ขอต่ออายุหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยสุขุมวิท ๔๑ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ขอต่ออายุหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีเงื่อนไขประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูล หรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๖ หากประสงค์จะต่ออายุหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออาชญากรรมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดของหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ทั้งนี้ผ่านเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบมาด้วย

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางจินดา เศษศิริพันธ์)
ผู้อำนวยการกองประเมินและควบคุมโรงงาน
ผู้รักษาความปลอดภัยกรมโรงงานอุตสาหกรรม



เป็นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเคมียมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๒๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๒๒ ต่อ ๒๑๓๗

ไปรษณีย์อิเล็กทรอนิกส์ sarabangdw@gmail.co.th

- ๑๖) นายศุภณัฐ คุณอนาญจน์
๑๗) นางสาวศิริภาพร เหมอินทร์
๑๘) นางจิตติมา ชำนิ
๑๙) นางสาวพรนิภา วีระจินดา
๒๐) นายนาเคนทร์ พันธุ์ชาติกุล

- ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๑๖
ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๑๗
ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๑๘
ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๑๙
ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๒๐

(นางจินดา เศษศิริพันธ์)
ผู้อำนวยการกองประเมินและควบคุมโรงงาน
ผู้รักษาความปลอดภัยกรมโรงงานอุตสาหกรรม

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕
ที่ อก ๐๓๑๐(๑)/ ๑๘๗๕ ลงวันที่ ๐ ๙ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

- ๑) นางสาวกชวรรณ พิธีกรกุล
๒) นายณรงค์ มีพาสี
๓) นางสาวนันทา บุญไชย
๔) นางปิยะพัชร สุทธิมนตรี
๕) นางมาลี วัฒนโย
๖) นางสาวบุญจรรยา วีระโยทัย
๗) นายณัฏฐ์ วงศ์บุรุษชัย
๘) นางสาวอริยวรรณ บุญลา
๙) นายสุวิทย์ จันทนา
๑๐) นางสาวจิตติมา สมบูรณ์
๑๑) นางสาวบุษกร เลิศกานดา
๑๒) นางสาววิไลลักษณ์ ศรีสุข
๑๓) นางสาวปริยา จรัสจิตต์
๑๔) นายศิลา บรรจงรักษ์
๑๕) นายปฏิกรณ์ คมธนา
๑๖) นายธีรวัฒน์ วัฒน
๑๗) นางสาวศิริพร ศรีประสิทธิ์
๑๘) นางสาวศิริ วีระ
๑๙) นางสาวพรพรรณ สุราษฎร์
๒๐) นายภูษณ์ พานิชกุล
๒๑) นายณัฐวัฒน์ แสงสวัสดิ์
๒๒) นายเอกวัฒน์ ปะคันนิทร์
๒๓) นางสาวนิศากร ศรีกุลสิทธิ์
๒๔) นางสาวเจตนาพร ทำสอาด
๒๕) นางสาวสุวรรณา คงทอง
๒๖) นางสาววรรณ พิศอกร
๒๗) นายวิฑูรย์ โมกแก้ว
๒๘) นายธีรพงษ์ เทพสถิต
๒๙) นายอนุชา นวลดี
๓๐) นายกรวิทย์ เขียวศรีกุล
๓๑) นางสาวอริยา วงศ์สวัสดิ์
๓๒) นางสาวนภสรณ์ คงคำ
๓๓) นายสุเชษฐ์ อรุณจันทร์
๓๔) นางสาวศศิธร อ่อนคำ
๓๕) นางสาวพรพรรณ สมบูรณ์ธรรม

- ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๐๑
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(นางจินดา เศษศิริพันธ์)
ผู้อำนวยการกองประเมินและควบคุมโรงงาน
ผู้รักษาความปลอดภัยกรมโรงงานอุตสาหกรรม

๑๖) นายภูณัฐ...

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕
ที่ อก ๐๓๑๐(๑)/ ๑๘๗๕ ลงวันที่ ๐ ๙ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

- ๑) นายสุกันต์ พันสิงห์
๒) นางสาวธรรมา แก้วชัยนอก
๓) นายพิรุณ ธีรฤกษ์
๔) นางสาววิไลลักษณ์ เกื้อสง
๕) นายสมชาติ สุทธิรัตน์
๖) นางสาวปรมาภรณ์ พงษ์แก้ว
๗) นางสาวกัญญา สมบูรณ์
๘) นายอรรถพร เทพทอง
๙) นางสาวอรรณพ พุทธิ
๑๐) นางสาววรรณิสา สายบุญเรือน
๑๑) นายภูษณ์ นามพิชัย
๑๒) นางสาวอรุณรัตน์ อ่อนคง
๑๓) นายกิตติศักดิ์ ทรงจำรัส
๑๔) นางสาวอริยาพร บุญคง
๑๕) นางสาวพรพิมล ม่วงทอง
๑๖) นายวิฑูรย์ สุวรรณระชา
๑๗) นายอภิวิทย์ ทั่วทั้ง
๑๘) นายณัฏฐ์ ปานโชติ
๑๙) นายศุภร อเนกพิรุณ
๒๐) นางสาวกัญญา ใยธา
๒๑) นางสาวภาวิณี สุทธิ
๒๒) นางสาวณณณัฐ อภิพัทธ์ภา
๒๓) นายพิรุณ จงคุณเกียรติ
๒๔) นางสาวสุภาวดี อินทศิริ
๒๕) นายพงศ์เทพ เหล่าจระ
๒๖) นายชัชวาลย์ พันทุ
๒๗) นางสาวพัชรา ศิริพิศาล
๒๘) นางสาวเมธิกา เสือคำจันทร์
๒๙) นายณัฏฐ์ พงษ์
๓๐) นางสาวสุธิดา เจริญพัฒน
๓๑) นายณัฏฐ์ จะโต
๓๒) นายพิรุณ ปิณฑิต
๓๓) นายพิลา โขชัยกุล
๓๔) นายชัชวาลย์ เลื่อนทอง
๓๕) นายปิยะนัฐ ศรีโรจน์

- ทะเบียนเลขที่ ๖-๑๕๕-๙-๐๐๐๑
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(นางจินดา เศษศิริพันธ์)
ผู้อำนวยการกองประเมินและควบคุมโรงงาน
ผู้รักษาความปลอดภัยกรมโรงงานอุตสาหกรรม

๑๖) นายณัฏฐ์...

(นางจินดา เกษะศรีนทร์)
ผู้อำนวยการกองวิจัยและพัฒนาสิ่งแวดล้อม
ปฏิบัติการแผนงานจัดการสิ่งแวดล้อมอุตสาหกรรม

(นางจินดา เกษศรีทวี)
ผู้อำนวยการศูนย์ส่งเสริมศิลปาชีวะ
ปฎิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ปฏิวัติราชการคณะราษฎรเปลี่ยนแปลงการปกครอง
 ปฏิวัติราชการคณะราษฎรเปลี่ยนแปลงการปกครอง

36 Oil & Grease...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
36	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽⁴⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
37	pH	Electrometric Method ⁽⁴⁾
38	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
40	Sulfide	1) Iodometric Method ⁽⁴⁾ 2) Methylene Blue Method ⁽⁴⁾
41	Temperature	Laboratory and Field Methods ⁽⁴⁾
42	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
43	Total Kjeldahl Nitrogen	Semi-Micro-Kjeldahl Method ⁽⁴⁾
44	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
45	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
46	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

น้ำใต้ดิน จำนวน 126 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <u>2.7.7.1</u>

4 Anthracene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
4	Anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
5	Antimony	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
7	Atrazine	1) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
8	Barium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
9	Benz(a)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <u>2.7.7.1</u>

15 Benzo(g,h,i)perylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
25	Carbon disulfide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <u>2.7.7.1</u>

30 Chlorodibromomethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	1) Colorimetric Method ⁽⁴⁾
36	Chrysene	1) Extraction, Air-Acetylene Flame Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾ <u>2.7.7.1</u>

42 Dibenz(a,h)anthracene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
42	Dibenz(a,h)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

58 Diethyl phthalate...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

70 Heptachlor epoxide...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
74	α-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
75	β-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
76	γ-HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

82 Manganese...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾
84	Methanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
87	Methylene chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

96 Polychlorinated Biphenyls...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
103	Silver	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
104	Styrene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

108 Toxaphene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
108	Toxaphene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₅ - C ₉)	1) Purge and Trap, Gas Chromatographic Method ^{(1),(2)} 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^{(1),(2)}
110	TPH (C ₁₀ - C ₁₄)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^{(9),(21)}
111	TPH (C ₁₅ - C ₃₃)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^{(9),(21)}
112	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
114	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
120	Vinyl acetate	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
121	Vinyl chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
122	m-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
123	o-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

124 p-Xylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
124	p-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
125	Xylene (Total)	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
126	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

ภาคพิเศษ (ปล่องระบาย) จำนวน 25 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
3	Cadmium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
4	Carbon Monoxide	Instrumental Analyzer Method ⁽³⁾
5	Chlorine	Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾
6	Chromium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
7	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
8	Copper	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
9	Cresol	Absorption Sampling, Gas Chromatographic Method ⁽³⁾

10 Dioxins/Furans...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
10	Dioxins/Furans	Isokinetic Sampling ⁽³⁾
11	Hydrogen Chloride	Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾
12	Hydrogen Fluoride	Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽³⁾
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
15	Manganese	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽³⁾
17	Nickel	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
18	Opacity	Ringelmann's Method ⁽¹⁾
19	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method ⁽³⁾ 2) Instrumental Analyzer Method ⁽³⁾
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ⁽³⁾ 2) Instrumental Analyzer Method ⁽³⁾
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ⁽³⁾
23	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ⁽³⁾
24	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
25	Xylene	1) Bag Sampling, Gas Chromatographic Method ⁽³⁾ 2) Adsorption Sampling, Gas Chromatographic Method ⁽³⁾

สิ่งปฏิกูล...

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 35 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
2	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,13)
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,15) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) 7.13

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
9	Chromium (III)	3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,14,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,13,16) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(2,16) 2) Alkaline Digestion, Colorimetric Method ^(8,16)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 3) 7.13

15 DDE...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(2,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) 7.13

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
23	Methoxychlor	3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁹⁾
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
26	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,23) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 3) 7.13

- 2,2',4,5,5'...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
27	- 2,2',4,5,5'- Pentachlorobiphenyl - 2,3,3',4',6- Pentachlorobiphenyl - 2,2',3,4,4',5'- Hexachlorobiphenyl - 2,2',3,4,5,5'- Hexachlorobiphenyl - 2,2',3,5,5',6- Hexachlorobiphenyl - 2,2',4,4',5,5'- Hexachlorobiphenyl - 2,2',3,3',4,4',5- Heptachlorobiphenyl - 2,2',3,4,4',5,5'- Heptachlorobiphenyl - 2,2',3,4,4',5,6- Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6- Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,9,28) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Electrometric Method ^(31,32)
28	pH	
29	Selenium	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,8,29) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,20) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

30 Silver...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
31	Thallium	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
32	Toxaphene	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22)
33	Trichloroethylene	2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(2,12,25) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13)
35	Zinc	2) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

ดิน จำนวน 125 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24)
2	Acetone	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(12,25) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)

3 Aldrin...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
4	Anthracene	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26)
5	Antimony	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
6	Arsenic	Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,15)
7	Atrazine	2) Digestion, Inductively Coupled Plasma Method ^(7,13) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
8	Barium	Digestion, Inductively Coupled Plasma Method ^(7,13)
9	Benz(a)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24)
10	Benzene	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
11	Benzo(b)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24)
12	Benzo(k)fluoranthene	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) 1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24)
13	Benzoic acid	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
14	Benzo(a)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

15 Benzo(g,h,i)perylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
16	Beryllium	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Digestion, Inductively Coupled Plasma Method ^(7,13)
17	Bis(2-chloroethyl)ether	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
18	Bis(2-ethylhexyl)phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
20	Bromofom	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
21	Butanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
22	Butyl benzyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
23	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14)
24	Carbazole	2) Digestion, Inductively Coupled Plasma Method ^(7,13) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
25	Carbon disulfide	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
27	Chlordane	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
28	p-Chloroaniline	2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)

31 Chloroform...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,16)
36	Chrysene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(28,29,30)
38	2,4-D	Ultrasonic Extraction, Gas Chromatographic Method ⁽²⁷⁾
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
42	Dibenz(a,h)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

43 Di-n-butyl phthalate...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
43	Di-n-butyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
47	3,3'-Dichlorobenzidine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
53	2,4-Dichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
58	Diethyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

60 2,4-Dinitrophenol...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
61	2,4-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
62	2,6-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
63	Di-n-Octyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
67	Fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
68	Fluorene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

71 Hexachlorobenzene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(10,25)
74	α-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
75	β-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
76	γ-HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
77	Hexachlorocyclopentadiene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
78	Hexachloroethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
79	Indeno(1,2,3-cd)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
80	Isophorone	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

83 Mercury...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 2) Digestion, Inductively Coupled Plasma Method ^(7,13) 3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁹⁾
84	Methanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
85	Methoxychlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
86	Methyl bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
87	Methylene chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
88	2-Methylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
89	2-Methylnaphthalene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
90	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
91	Naphthalene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
92	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
93	Nitrobenzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
94	N-Nitrosodiphenylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
95	N-Nitrosodi-n-propylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

96 Polychlorinated Biphenyls...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 Polychlorinated Biphenyls - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5-Trichlorobiphenyl - 2,4',5-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6-Heptachlorobiphenyl	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26) Ultrasonic Extraction, Gas Chromatographic Method ^(10,23)

- 2,2',3,4',5,5',6...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
97	- 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl Pentachlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
98	Phenanthrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
100	Pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,22) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
102	Silver	Digestion, Inductively Coupled Plasma Method ^(7,13)
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
107	Toxaphene	Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
108	TPH (C ₉ -C ₉)	1) Purge and Trap, Gas Chromatographic Method ^(12,21) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
109	TPH (C ₁₀ -C ₁₄)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,21)
110	TPH (C ₁₄ -C ₂₈)	Ultrasonic Extraction, Gas Chromatographic Method ^(10,21)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)

112 1,1,1-Trichloroethane...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
115	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
116	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
118	Vanadium	Digestion, Inductively Coupled Plasma Method ^(7,13)
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
125	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

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